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Cysts and Tumors of Jaws—*Lyons*
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Occlusion and Operative Dentistry—*Dewey*
Removal of Impacted Molar—*Fahy*

EDITORIAL

One Thing Needful

DENTAL HEALTH EDUCATION

Health Education—*Rector*

THIRTY-FIVE CENTS

CONTENTS

Board of Trustees, American Dental Association, 1927-1928 ..... Frontispiece

ORIGINAL COMMUNICATIONS

The Roentgenogram as a Diagnostic Aid in Planning Partial Restorations.
By John Oppie McCall, A.B., D.D.S., F.A.A.P., F.A.C.D. 993
Growth and Movement of the Tooth Germs and Teeth.
By B. Orban, M.D. 1004
A Consideration of Some Aspects of Gingivitis.
By Robert A. Kilduffe, A.M., M.D. 1017
Impressions for Full Dentures.
By Elbert C. Pendleton, D.D.S. 1027
Dental Economics.
By R. C. Willett, D.M.D. 1038
Habit as a Causative Factor in Malocclusion.
By William E. Flesher, D.D.S. 1044
Dental Research at the National Bureau of Standards.
By George K. Burgess 1053
A Qualitative and Quantitative Consideration of the Cells in Normal Blood: Part 1.
By Irwin A. Epstein, D.D.S. 1055
Preliminary Steps in the Prevention of Pyorrhea.
By Austin F. James, D.D.S. 1072
Prophylactodontia.
By Frederick A. Bricker, D.D.S. 1073
Stimulation of the Gingiva.
By Paul R. Stillman, D.D.S., F.A.C.D., F.A.A.P. 1077
Constitutional Factors in Periodontitis.
By Carl V. Weller, M.S., M.D. 1081
The Principles of Preventive Periodontia.
By Arthur H. Merritt, D.D.S., F.A.C.D. 1086
The Importance of the Recognition of Cysts and Tumors of the Jaws.
By Chalmers J. Lyons, D.D.Sc. 1090
A Histologic Study of a Tooth Peculiarly Impaired in Function.
By Horace E. Jones, D.D.S. 1100
Anatomic Influences on the Establishment of Balanced Jaw Relations and Balanced Occlusions.
By Walter H. Wright, D.D.S., F.A.C.D. 1102
The Relation of Physics and Physiology to Balanced Occlusions.
By R. O. Schlosser, D.D.S. 1108
Channel Type Posterior Tooth Forms.
By Victor H. Sears, D.D.S. 1111
Influences of Mandibular Movements on Balanced Occlusion.
By Alexander H. Paterson, D.D.S., F.A.C.D. 1118
Further Studies on the Etiology of Pulp Canal Infections with Special Reference to Diagnosis and Treatment.
By U. G. Rickert, A.M., D.D.S., and Faith Palmerlee Hadley, M.S. 1124
Forces of Occlusion and Their Relation to Operative Dentistry.
By Martin Dewey, D.D.S. 1130
Functional Restoration as an Element in Facial Repair.
By J. Eastman Sheehan, M.D., F.A.C.S. 1135
Treatment Following the Removal of the Impacted Mandibular Third Molar.
By George C. Fahy, D.D.S. 1138
Foreign Bodies of Dental Origin in the Air Passages.
By Louis Ginsburg, B.S., M.D. 1143
An Interesting Case of Impaction of a Right Upper Cuspid.
By T. J. Geren, D.D.S. 1146

EDITORIAL DEPARTMENT

The One Thing Needful.—Attend Your Meetings.—C. Edmund Kells, D.D.S. (1856-1928) 1147-1152

BUREAU OF DENTAL HEALTH EDUCATION

Tendencies in Health Education.
By Frank L. Rector, B.S., M.D. 1153
The Nurse and Teacher in a Public Health Dental Program.
By William R. Davis, A.B., D.D.S. 1156
Public and Professional Usefulness of the Dental Hygienist.
By Ethel Covington 1160
Some of the Newer Phases of Oral Hygiene Work in Los Angeles County Health Department.
By Emma Durbin 1164

CURRENT LITERATURE

Extracts and Abstracts 1167

MISCELLANY

Book Reviews 1170
Correspondence 1173
News 1174

ANNOUNCEMENTS

Announcements 1176

ADVERTISING

Index to Advertisements A-65
Classified Section A-57, A-58, A-59

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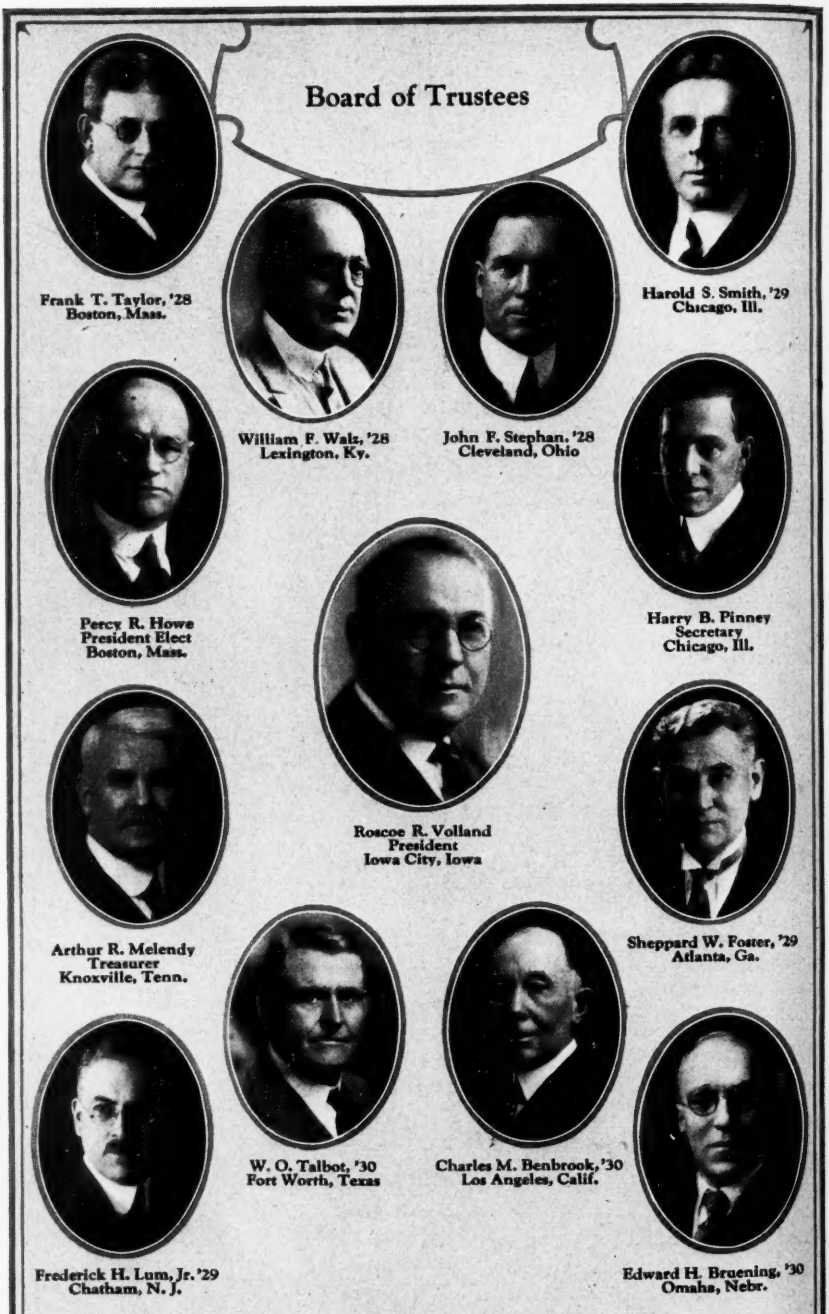

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THE JOURNAL
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Original Communications

THE ROENTGENOGRAM AS A DIAGNOSTIC AID IN PLANNING PARTIAL RESTORATIONS*

By JOHN OPPIE McCALL, A. B., D. D. S., F. A. A. P., F. A. C. D., New York City

THE field of partial restorations is perhaps the most complex branch of dental practice. In the planning and construction of partial restorations, the dentist is first confronted with an almost unbelievable number of variations in the matter of the number of missing teeth and the location in the mouth of the remaining teeth. If all these remaining teeth were normally placed and had fully formed roots free from periapical and periodontal disease, the problem would still be difficult. But nearly every case which requires partial restoration presents further variations as to the position and health of the remaining natural teeth. Not all departures from health are serious in this field, nor are all malpositions a barrier to success. But many of these conditions cannot be corrected or else are a constant source of tribulation after the restoration has been made.

In addition to possible departures from the normal, as regards the teeth remaining in the mouth, there is also to be considered the condition of the edentulous areas. Here, we may find retained roots, unerupted teeth, residual infections and bone presenting an irregular border or lacking the usual arrangement of trabeculae and cancellous spaces within its body. These things all have an import for the dentist who would make bridges or partial dentures.

We have made considerable progress in recent years in what may be called the mechanical aspects of partial restoration construction. This is evidenced, for one thing, by the increasing use of the adaptable articulator in this field. With the aid of this instrument, balancing of the occlusion has been receiving greater attention. However, conversations with various dentists who are especially in-

*Read before the Section on Partial Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

terested in partial restorations have led me to believe that there is room for the further consideration of elements which center in the health of the natural teeth, and the condition of the edentulous regions.

In regard to these matters, the use of the roentgen-ray comes at once to mind. And here we see well exemplified the need for close cooperation between the various specialties in dentistry. The roentgen-ray film itself is only of value when read by one who knows both clinically and from laboratory experience what its various lights and shadows mean. The man who does nothing but take roentgenograms will never be able to interpret them simply through a repetition of the process. He must learn, either by his own observations or through the teaching of others, what is the normal and what the abnormal. This statement may sound trite and superfluous. It is well to call to mind the way in which we have built up our present knowledge of roentgen-ray interpretation. Most of the opinions we hold as regards certain typical roentgen-ray shadows have been absorbed almost unconsciously through contact with others, who may or may not have had a trustworthy basis for their statements. There has been comparatively little scientific examination of areas which have been radiographed. We have, therefore, to depend largely on clinical evidence. This means that the root canal worker learns what he can from his roentgenograms by experience. The oral surgeon also learns to interpret roentgenograms in terms of gross conditions which he finds during his operations. And the peridontist learns of the conditions which he treats by correlation of his findings with the roentgen-ray findings. While not entirely satisfactory, this method has given us much helpful information.

Fig. 1.—Typical aveoloclasia on lower bicuspids. Prognosis will be favorable if stress of denture support and retention can be distributed. Cast continuous lingual clasp with occlusal rests on bicuspids and cuspids is indicated.

Fig. 2.—Condition similar to that in Figure 1; prognosis less favorable because of pericemental disturbance at the apex.

The partial denture worker or bridge worker, in applying the roentgen-ray to his problems, must acquire a knowledge of radiographic interpretation by conference with representatives of each of the groups mentioned. This is merely another way of stating the fact that specialization is only of value when it makes useful contributions to the general practice of dentistry.

In the field of partial restoration, it would seem that the first concern of the dentist should be for the health of the tissues involved. As regards the teeth, this means, first, freedom from periapical

disease. We are familiar with that type of periapical disease which is associated so frequently with the pulpless tooth. On this phase of the subject, I shall touch but lightly. No pulpless tooth showing discernible evidence of periapical disease should be used for any form of anchorage. Nor should such a tooth be retained anywhere in a mouth which is to receive a partial restoration, unless the tooth, if lost later on, can be restored without the complete rebuilding of the original restoration. When a partial restoration is required for a patient who is in a chronic state of impaired health which may be attributable to focal infection, the retention of any pulpless tooth, whether it gives roentgenographic evidence of infection or not, is questionable.

Fig. 3.—Bicuspid and molar each with pocket on mesial side. Note amount of supporting bone on the distal side. Prognosis is favorable if stress of denture or bridge is properly distributed.

Fig. 4.—Molar similar to that in Fig. 3; bicuspid unfavorable. Note residual infection in first molar region. In addition to its metastatic significance, this area connotes a poor ridge for saddle support.

Less has been written about periapical disease, or let us say, periapical abnormality, quite often found in cases where the pulp is vital. I think it is timely to make the statement that vital pulps are not invariably healthy and that they may induce periapical disorders, especially if the teeth are subjected to abnormal conditions such as are involved in the retention or support of partial restorations. It is of first importance that such possibilities shall be recognized, and that means for diagnosis leading to their discovery shall be made a matter of general knowledge. To have a bridge or partial denture fail because of disease which could have been foreseen is highly unfortunate, to say the least.

Teeth which have been subjected to traumatic occlusion over a long period of years may develop pulp disturbance instead of the more common periodontal disease. This may be the result of a pericemental congestion, centering at the root apex, with pulp symptoms as a sequel. The order of events is unimportant, since the pulp disturbance has a tendency to become firmly established, in which case periapical disease will usually become as thoroughly established. In the roentgenogram this condition is nearly always demonstrated with certainty. In the early stages, there is a slight widening of the pericemental space, without perceptible alteration in the quality of the lamina dura. As the condition becomes more aggravated, the pericemental space becomes still wider, and the lamina dura loses its definition. The appearance is usually distinct from that of the granuloma of the pulpless tooth, into which, however, it tends to degenerate. Such a tooth is a poor risk

for a bridge abutment or for an attachment of a removable appliance.

Another type of disturbance which requires consideration here is commonly called "condensing osteitis." Since it is not invariably and necessarily inflammatory in its nature, but may often be physiologic, this name is probably not well chosen. We may refer to it simply as "alveolar condensation." It has two principal manifestations in relation to the teeth, which may occur either alone or in combination. The first is a condensation occurring in the socket wall, or lamina dura, along the side of the root. The lamina dura, contrary to common belief, is not a distinct layer of dense bone, but simply bone which is relatively denser than that beyond the actual socket wall. When we speak of condensation involving the lamina dura, we are speaking in relative terms only, and must use as a basis of comparison the type and density of structure observed in the highest percentage of supposedly normal cases. On this somewhat indefinite basis, we may develop a conception that certain teeth tend to acquire an abnormal condensation of the alveolar wall. When this condensation is confined chiefly to the sides of the root, in contradistinction to its apex, the condition may be considered physiologic, that is, a response to a normal stimulus. Such a tooth should apparently afford excellent anchorage for an appliance. This stimulus, however, is the stimulus of increased function, and is frequently traumatic, owing to an abnormal position or tipping of the tooth. Under such circumstances, the building up process tends to be followed by a breaking down, with development of periodontal disease. Frequently, the two processes seem to be going on simultaneously around the tooth. This is evidenced in the roentgenogram by the characteristic white appearance of dense bone along the middle and apical thirds of the root, while a dark zone of rarefaction is to be seen nearer the neck of the tooth. When this rarefaction is seen, the occlusion of the tooth must be studied with the greatest care to determine whether the necessary relief can be given, before putting any considerable dependence on the tooth for anchorage.

Fig. 5.—Periapical disturbance on second bicuspid. No devitalized teeth showing periapical abnormality should be used as a bridge abutment.

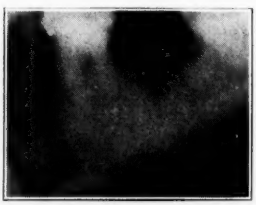

Fig. 6.—Periapical condensation on first molar. The distribution of the dense bone points clearly to infection; unsuitable for bridge abutment. This applies equally to vital teeth showing this type of condensation.

The other location of alveolar condensation relative to the tooth is at and around the apex. Here, we have a condition which often merits the name condensing osteitis, as it is frequently inflammatory in its nature. It may be found at the apices of infected nonvital

teeth and also at the apices of certain vital teeth. In the former case, it is to be taken as an indication of infection. In the latter case, it may be the result of infection in the still vital pulp. In such cases, the roentgenogram usually shows fillings in close proximity to the pulp, and the pulp almost invariably loses its vitality later on. In other cases, there is no evidence of primary pulp infection, the apical condensation seeming to be simply an extension of the condensation along the side of the root. If the periapical bone becomes very dense, the blood supply to the pulp will be seriously interfered with. Clinically, these cases also tend to progress to pulp death. It may therefore be said that marked periapical condensation is an indication of an unsatisfactory condition, and one which should warn the operator to avoid the use of a tooth so involved as an abutment or anchor tooth.

Fig. 7.—Hypercementosis on bicuspid. If vital and showing no periapical abnormality, such a tooth should make a satisfactory bridge abutment.

Bone condensation is often seen in the body of the mandible, and sometimes in the maxilla, where teeth are missing. It is often a residual condition, persisting after the extraction of the tooth, which was its *raison d'etre*. It may or may not be infected, present day opinion, based on seemingly incomplete evidence, being that most of these dense masses are not infected. They are, however, to be regarded with suspicion from this standpoint. When occurring near the surface of the bone, they offer a possibility of unconventional behavior under saddle pressure, which should be considered, whether or not the element of infection seems to be present.

Hypercementosis is a condition frequently detected in the roentgenogram. It is variously interpreted at the present day. It is found on both vital and nonvital teeth. It may be generally distributed in a mouth, but is more commonly seen on a few, or on only one, of the teeth. When occurring on a pulpless tooth, it is to be regarded with suspicion as an indication of possible pericemental disease, produced by a chronic infection. It is therefore of possible metastatic import. When the tooth is vital, on the other hand, the hypercementosis seems less serious. If acceptable from the health standpoint, the added support which is provided by the enlarged root area makes such a tooth particularly valuable in the retention of partial restorations.

Fig. 8. — Hypercementosis on bicuspid. There is slight rarefaction at the apex, and bone condensation beyond the rarefied area. Infection is indicated.

When a tooth is found, by means of the roentgen-ray, to have an unusually small or short root, the import is clear

and need not be enlarged on. Special care, however, must be taken to distinguish the tooth whose root is, perhaps, slightly shorter than normal, yet perfectly formed, from the root which was originally full length, but which has suffered absorption of the apical portion. Such absorption is a sign of disease. Its significance is not merely in the fact of disease, but also in the fact that the absorptive process is progressive. Such a condition should call for extraction of the tooth before partial restorations are undertaken, particularly if the tooth in question would, if retained, be used for stabilizing the appliance.

Fig. 9.—Root tip of first molar in bone. Note elevation of alveolar border opposite this fragment. Unsatisfactory for saddle, root tip probably infected.

The inclination of the teeth, both as seen in the mouth and as revealed in the roentgenogram, should be studied most carefully. Teeth which are tipped most noticeably from their normal position seldom give satisfaction when used as abutments or retainers. If the tooth is tipped away from the appliance, as, for instance, when a lower bicuspid is tipped mesially, the saddle is very liable to cause undue compression of the tissue over the alveolar border at the distal side of the tooth. Occlusal rests may only partially alleviate this condition, since the pressure so induced usually produces mobility of the teeth, in which case compression of the gingiva will soon follow.

Retained roots, unerupted teeth and cysts require no comment. There is opportunity for careful study of rarefied areas in edentulous bone, and also for irregular alveolar borders. Rarefied areas present possibly the most difficult problem in roentgen-ray diagnosis at the present date. The problem is not wholly in the field of focal infection. The problem of support for saddles in such cases is an intricate one. At present, we can only suggest extreme caution in placing saddles over such areas, and the necessity of warning the patient of possible abnormal settling of the appliance after insertion. When the rarefied area is closely associated with an irregularity of the alveolar border, our suspicion of residual infection is much strengthened. Such areas should invariably be recommended for curettage.

Fig. 10.—Root tip remaining deep in bone. Note rarefaction immediately adjacent to it with condensation beyond rarefied zone. Infection is indicated.

Periodontal disease is the bugbear of the bridge and partial denture worker. The roentgenogram, because it indicates clearly the amount and quality of alveolar support, is the most certain aid in determining this condition. Teeth which have lost part of their alveolar support are not necessarily to be condemned for bridge or partial denture work. But as the amount of alveolar

absorption increases, the necessity also becomes greater for relieving the tooth as much as possible of its functional responsibility. Such teeth should have as little vertical stress as possible, as, for instance, occlusal rests, or their equivalent. But more particularly should they be protected as far as possible from lateral stress. This protection may be provided by including other teeth in the appliance as indirect retainers.

The distribution of alveolar bone, in cases of beginning absorption, is very

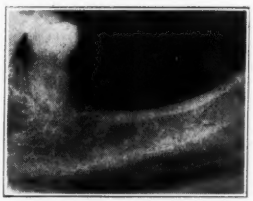

Fig. 11.—Root absorption. Such a tooth, while firm at the time the roentgenogram was taken, would have but a short life as an abutment or retainer.

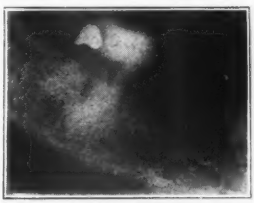

Fig. 12.—Root absorption. This condition is progressive; hence, the tooth is not to be depended on as an abutment or retainer.

important. Teeth which have alveolar bone nearly or quite intact on one or two sides of the root may be acceptable for supporting an appliance, even though fairly advanced absorption has occurred on another surface. The questionable tooth is one which shows marked alveolar absorption equally advanced on all sides of the root.

Alveolar absorption is always to be regarded as a symptom of periodontal disease, whether pus pockets are present or not. When seen in the roentgen-ray, therefore, the case should always have competent periodontic treatment before or during the construction of the appliance.

Before bringing this paper to a close, it will be well to mention the matter of roentgen-ray technic. In spite of the long experience which the dental profession has had with the roentgen-ray, there is a surprising variation in the technic of taking roentgenograms and an unduly large number of poor roentgenograms are being turned out. The matter of technic is beyond the scope of this paper, and it need only be said that an acceptable roentgen-ray film should show clearly all of the structures which are of interest to the dentist. This will permit of individual variations in technic, but each operator should at least have a standardized technic which will permit of dependable comparisons between the films which he takes. The roentgen-ray becomes for him an additional pair of glasses with which he sees the hidden structures of his patients' mouths. And one dentist may fail to interpret satisfactorily the films of another dentist, just as one individual may not be able to read through the eyeglasses fitted to the eyes of another.

The bridge worker has long recognized the necessity for taking roentgenograms of proposed abutment teeth. The employment of the roentgen-ray as a routine in partial denture work is not so nearly universal. It is to be hoped that the points suggested in this paper will impress on both groups the necessity for roentgenograms, not only of abutment teeth, but also of all teeth

remaining in the mouth and of edentulous areas as well.

The bridge worker and more particularly the partial denture worker have for too long carried the stigmata of the mechanic. It is time that the health of the oral tissues be made the first requirement and the second the insertion of an appliance which should restore function. The roentgen-ray is the first aid in the carrying out of this program.

Fig. 13.—Root absorption of, with the socket filling in with dense bone.

DISCUSSION

Hugh W. MacMillan, Cincinnati, Ohio: A significant statement occurring in Dr. McCall's paper is the following: "Most of the opinions we hold as regards certain typical roentgen-ray shadows have been absorbed almost unconsciously through contact with others, who may or may not have had a trustworthy basis for their statements." First, concerning the term "residual infection": What is "the way in which we have built up our present knowledge" concerning this recent addition to dental nomenclature? Have we built up our present knowledge by a study of the changes which result in the healing of a normal socket? Has it been recognized that the laws governing the deposition and resorption of bone varies in each alveolus? Has the influence of functional activity or that of disuse been investigated in the interpretation of the cancellous pattern? Does the age of the patient have any influence on the type of bone rebuilding the alveolus? Has there been a comparison of repair in other bones under similar conditions of stress? Was the area formerly occupied by a vital tooth or by a tooth exhibiting destruction of periapical bone? Was the bone which formerly occupied the area under consideration operated on by the infamous radical alveolectomy method? Is the area in a neutral zone and therefore a physiologic phenomenon? Was there a healthy alveolar border or extensive bone destruction? How does the appearance of an area of operation differ roentgenographically after healing? What are the organisms found in these areas? How can it be determined whether all the residual infection has been removed? How can it be determined that the area after healing is free from infection? These and many

Fig. 14.—Residual infection in region of first molar. Note bone condensation around the rarefied area.

other questions concerning this illegitimate addition to dental practice have never been answered, and until they are answered, the term or the condition which it describes has no place in scientific literature. Residual infection is a sonorous, high sounding, impressive, terrifying term popularized by those charlatans and unprincipled money getters as service selling stuff and adopted by unthinking and misled men either through acquiescence or ennui. Traumatic occlusion! What is the fountain head of our present knowledge regarding this new disease? Where is the laboratory or experimental proof? Men have gloriously given their lives to further knowledge concerning yellow fever, but no recorded instance has come to light in which one healthy tooth has been intentionally sacrificed by deliberately placing it in "traumatic occlusion" and then recording roentgenographically and histologically the successive retrogressive (?) changes for the benefit of other tottering teeth or for the substantiation of unconvincing theories. A number of questions could be asked relative to the pedigree of this mistaken conviction, but as several have been asked before in published papers and not answered—why continue? It might be of

interest to report Gottlieb's opinion given before the Cincinnati Dental Society. He said that "traumatic occlusion" never produced destructive disturbances in the tissue surrounding a tooth while the tooth was firm in its socket. He then illustrated with his fingers how, after the tooth was loosened, it was impossible for compensatory abrasion to take place, and how, then and then only, antagonism with the opposing tooth resulted in an irritation or, as he termed it, traumatic occlusion. To this conception, we all agree, but the "traumatic occlusion" described by Gottlieb and that described by American writers are not of the same family. Evidently, Gottlieb does not think "traumatic occlusion" is a prime etiologic factor in periodontoclasia or even a predisposing one. To quote from Dr. McCall's paper: "Teeth which have been

Fig. 15.—Failure of socket of left lateral to fill in properly. Infection is indicated by ragged walls of socket. The saddle support is unsatisfactory.

Fig. 16.—Failure of socket of lateral incisor to fill in completely. Note small nodule of detached bone at border near central incisor. Infection is not definitely indicated.

subjected to traumatic occlusion over a long period of years may develop pulp disturbance instead of the more common periodontal disease. This may be the result of a pericemental congestion, centering at the root apex, with pulp symptoms as a sequel. The order of events is, however, unimportant. . . ." If there is anything important in dental diagnosis, it is an accurate description of the succession of events which leads to pulp disturbance from any cause whatsoever. A classic description of the histologic changes in inflammation which can be gotten from any textbook is not sufficient explanation. To attempt to describe pulp disturbance, claimed to be brought about by "traumatic occlusion," by roentgenographic evidence alone is preposterous. Pulp disturbances associated with tenderness of the tooth to percussion too often occur in teeth without the least discernible evidence in the roentgenogram of changes in the pericementum or surrounding bone, even though the roentgenograms were made with meticulous care from every conceivable angle and with different degrees of penetration. Only after extraction of the tooth and examination of the pulp has the diagnosis been confirmed. To those who have attempted to record by the roentgenogram the thin filigree of the spongiosa in dry specimens of uniform thickness under ideal conditions, the futility of depending on the roentgenogram for nicety in diagnosis is apparent. Similarly, Dr. McCall's description of condensing osteitis resulting from infection in the still vital pulp is a phenomenon which I cannot follow. Perhaps the answer is in the interpretation of the term vital. If appropriate tests are positive, vital means normal. If the tests show a discrepancy in reaction to high and low temperatures, vital means partly dead. Before continuing the argument, the terms "vital" and "normal" must be more closely defined. Another cause of pulp disturbance much more effective than "traumatic occlusion" is infected dentin. A vital pulp being "disturbed by traumatic occlusion" must be free from fillings and not influenced by infected dentin because that always complicates the explanation. A recent book[1] highly recommended by *The Journal of the American Medical Association* describes the confusion

1. Chase, Stuart, and Schlink, F. J.: Getting Your Money's Worth, New York: The Macmillan Company, 1927.

in the mind of the average consumer in attempting to select intelligently almost any article offered for sale. Quoting from the book: "We are all Alices in a Wonderland of conflicting claims, bright promises, fancy packages, soaring words, and almost impenetrable ignorance." This statement describes just as accurately the state of mind of the average dentist in attempting to fathom some of the theories and practices described in dental literature. Verily, in order to understand these conflicting statements, it is necessary to follow the advice of the Queen to Alice in Wonderland: "I can't believe that," said Alice. "Can't you?" the Queen said in a pitying tone. "Try again: draw a long breath, and shut your eyes."

Clarence O. Simpson, St. Louis, Mo.: Unquestionably, the construction of partial replacements presents highly complex problems. Whether or not it is unanimously conceded as the most complex branch of dental practice, as it is characterized by Dr. McCall, it surely is from a constructive standpoint. Do the inherent difficulties of partial dentures explain the limiting of practice to full dentures by so many men? Or do patients reach an appreciation of specialized service only after all of their teeth are lost? In either case, there is a special field for the scientific construction of partial replacements, instead of condemning serviceable teeth for full artificial dentures. One of the most praiseworthy features of this paper is Dr. McCall's plea for closer cooperation between the specialties of dentistry. The similarity and relation of the perplexing problems in each specialty demand collaboration for prompt and correct solution. Radiodontia is an influential correlative factor in establishing diagnostic principles applicable to all dental specialties. The development of radiodontia is prompted by the requirements of other specialties. In vividly describing the indication for roentgenography in partial replacements, Dr. McCall has contributed to the advancement of both prosthodontia and radiodontia, and the comprehensive view of a periodontist is convincing. The prosthodontist who confines his study to mechanics is no more logical than the periodontist who relies on superficial inspection and instrumental examination to the exclusion of roentgenographic evidence. The reference to disturbance from diseased pulps is a much needed warning because, in the overzealous eradication of pulpless teeth, degenerative pulps have been neglected. A more effective elimination of septic foci would have been accomplished by attention to partially vital but infected pulps than by the removal of pulpless teeth with roentgenographically normal periapical structures. However, there is little opportunity to diagnose these or other incipient lesions from crude roentgenographic examinations which reveal only canal fillings and gross involvements. The concisely stated requisite of acceptable roentgenograms, as showing all of the structures which are of interest to the dentist, sets a standard which is not generally attained. In fact, there is an element of futility in discussing the application of roentgenography for any purpose, when adequate roentgenographic service is so rare. The conclusions expressed on condensing osteitis and sclerotic bone are in harmony with the present data, excepting the importance which is attached to periapical condensation adjacent to vital teeth. This may be more coincidental than significant. An unwarranted deduction and discrimination seems to be made between hypercementosis on vital and on pulpless teeth. Although the stimulus of cemental hyperplasia was a low-grade infection, if the apical foramina are hermetically sealed, the defensive process is effective. Rarefied or imperfectly repaired edentulous areas are rather pessimistically interpreted. The reproduction of identical patterns should not be expected in repaired bone, and the altered function following the loss of teeth results in reduction of the alveolar process and trabecular atrophy. Dr. MacMillan has made notable investigations alone this line. There is a characteristic roentgenographic appearance to septic crypts which should be distinguished from imperfect regeneration. Especially, the pathologic status of edentulous alveolar process should not be decided by its resistance to curettage, because the texture is different from the bone supporting functioning teeth. A more diligent study of interpretation may prove the needed incentive for technical improvement in roentgenography. Any method which will achieve this result is justifiable.

Dr. McCall (closing): Dr. Simpson spoke of the question of periapical condensation on vital teeth. Dr. MacMillan also brought

up that point. What I am stating in this connection is the result of continued observation, not simply taking the roentgen-ray picture today and finding condensation around the apex of that tooth, making a test of that tooth and finding it vital, and drawing my ideas from that one experience. Some of these cases have been under my observation for a good many years. And in such cases I have often found the pulp losing its vitality at a later date. It is on that ground only that I would caution you, because I have often seen these cases end in pulp death and frequently with a degree of pericemental involvement which did not yield readily to pulp canal treatment at that time. Dr. Simpson also spoke of the matter of hypercementosis, with regard to teeth known to be vital. His point is well taken, that if the root canal can be thoroughly cleansed and sealed with a root filling, so that infection is excluded at least from the interior of the tooth, the member should be satisfactory. But the thing which I wish to call to your attention is the fact that the hypercementosis may bring about in the course of time a condition in which there will be a lowered resistance at the apex of that tooth, and then the tooth becomes a possible subject of periapical disease and infection. How are we to know whether an area which we regard in the roentgenogram as exhibiting traces of residual infection is actually harboring living bacteria? The evidence that I have had on that point has been gained, in the first place, through personal operation on such areas some years ago when I was carrying on an active investigation. I found many of them infected; I think I can say sometimes, without having to go to the microscope or to the bacteriologic laboratory, that infection is present, even if there is no actual pus to be seen with the naked eye. Then, of course, there have been cases in which surgeons operated, and they have agreed with my diagnosis, not having any particular reason for agreeing with me except simply the matter of stating the truth as they saw it. I have also had a number of cases in which the bone tissues, not soft tissues, mind you, but actual bone tissues, has been removed from these areas and has been examined microscopically. Some of these areas, on culture, have yielded staphylococcus and streptococcus. Now, there is evidence which is, I think, entirely satisfactory that sometimes these rarefied areas in bone are actually infected. Frequently, they are not infected; but until we have a better means of diagnosis than I know of at the present time, it is well to be very cautious regarding the handling of cases in which these areas appear. I agree with Dr. MacMillan that the bone does not always fill in, in what we would say, for lack of a better term, a normal manner after tooth extraction, but it does so in a large number of cases, and when it doesn't fill in properly, we should at least have our suspicions aroused. Dr. MacMillan states that no person has voluntarily come forward and had a traumatic occlusion produced on a perfectly healthy tooth, offering that tooth, I assume he means, for histologic study afterwards. That, of course, has not been done. We have many cases of traumatic occlusion being produced on healthy teeth through the efforts of the bridge workers in the past. We hope this will not be true in the future. These things are more or less involuntary, as far as the patient is concerned. We can follow in the roentgenogram the changes that take place after such a condition has been produced, and we have a fair knowledge of what is going on there. It is desirable, as Dr. MacMillan suggests, that actual experimental work be deliberately planned and carried out to the extent of removal of the tooth and tissue and examination by the laboratory be made in order that we may round out our story. I should be surprised if the final story did not agree pretty well in its essentials with the details that we have already stated. Dr. Gottlieb's ideas of traumatic occlusion were not unfamiliar to me. His idea, as I gathered it, in conversation with him, is a little different from that which Dr. MacMillan has stated. Dr. Gottlieb believes that if we have thirty-two teeth in the mouth in any kind of decent alinement, firm and healthy to start with, there will be some wear on those teeth through their use and function which will eliminate slight irregularities and prevent the development of other irregularities, and in those cases traumatic occlusion does not occur. Now, the statements as made by Dr. Gottlieb implied so nearly an ideal occlusal relationship in the beginning that none of us would expect to find traumatic occlusion in those cases. But he did agree

with me and with Dr. Stillman when we called to his attention cases in which the arches, for instance, are constricted. Here, there is likely to be a marked overbite of the anterior teeth. In such a case, we have traumatic occlusion from the time the teeth are erupted, and this condition will be accentuated by inharmonious wear. Dr. Gottlieb agrees that traumatic occlusion is a disturbing factor when it occurs, and I believe that his views on this point are not far from the views held by Dr. Stillman, for instance, who has championed the cause of traumatic occlusion for so many years. With regard to the order of events in pulp disturbance: I said that if we had condensation of the bone at the apex of the tooth, it might be produced there in the first place by traumatic occlusion, or it might be produced through pulp disease, which, in its turn, had been initiated by traumatic occlusion or by the insertion of fillings close to the pulp, etc. I said that I did not particularly care what the order of events was. Dr. MacMillan has criticized my statement and justly so. What I meant to convey was the thought that I was chiefly interested in was what would happen ultimately in that type of case. And many times I have seen these pulps die at some later date after I have observed this condensation in the roentgenogram. In a study of the actual pathology of this process, it is important, of course, to know which event took place first. It is very important to distinguish between the vital pulp and the one which is both vital and normal, and I do not believe that we have yet an entirely satisfactory means of making this diagnosis. I don't pretend to say how we are going to proceed to get a better diagnosis, but the mere fact that we failed to devise a satisfactory method of diagnosis of the health of the pulp is all the more reason why we should study our roentgenograms and clinical evidence with the greatest of care in order to determine any signs of disturbance of the pulp which may be there for us to see.

GROWTH AND MOVEMENT OF THE TOOTH GERMS AND TEETH*

By B. ORBAN, M.D., Chicago, Illinois

THE investigators of the development of the teeth believed that teeth so form that, at a certain stage of development (at about 11 mm. length of the embryo), a part of the epithelium of the mouth begins to grow into the connective tissue, building up the dental ridge. These workers believed that after the dental ridge had attained a certain length, the dental lamina and tooth germs began to develop.

My investigations on extensive material in the Second Anatomical Institute of Vienna (director, Prof. Dr. F. Hochstetter,) have shown surprising and entirely different results from those mentioned above.

I have made measurements on embryos from the length of 16 mm. to that of 217 mm. I measured the distance from the floor of the nose to the deepest point of the tooth germs, the length of the germs, and the distance of the germs from the mouth epithelium. This is diagrammatically shown in Figure 1.

Figure 2 shows the results of my measurements. It may be observed that

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the length of *a* is the shortest in the smallest embryo, and does not become shorter in the course of development, though neither is there much increase in length. The increase in length from the floor of the nose to the mouth epithelium is due to the growth of *b*, which is the tooth germ, and of *c*, which is the dental lamina. Therefore, I can state that the epithelium of the mouth does not grow into the connective tissue in such a way as to build up the dental lamina and tooth germs, but certain parts of the mouth epithelium remain at their original places while the surrounding tissue grows. Of course, there is some growth also in the epithelium of the dental lamina and in the tooth germs, but this is not an active invading growth but a synchronous growth with that of the surrounding tissues.

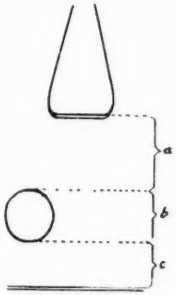


Fig. 1.—*a*, distance from the floor of the nose to the deepest point of the tooth germ; *b*, length of the tooth germ; *c*, distance from the tooth germ to the mouth epithelium.

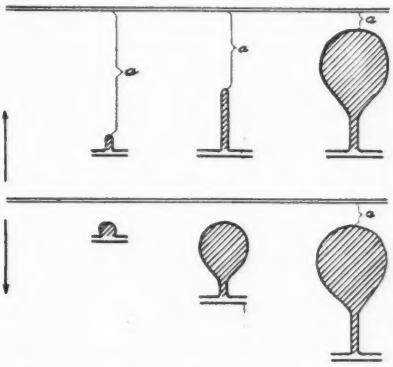


Fig. 3.—Above: The old conception of the development of the dental ledge and tooth germs. In the course of development, the dental ledge becomes always longer and the distance *a* decreases. After the dental ledge has attained a certain length, the tooth germs develop. Below: Diagram illustrating author's point of view. The tooth germs exist when the dental ledge is just beginning to develop. Tooth germs and dental ledge grow simultaneously in such a measure as the surrounding tissues grow in the direction of the arrow.

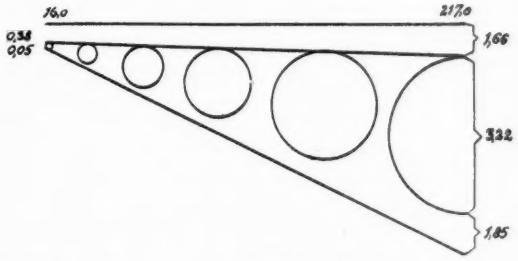


Fig. 2.—Results of measurements. The length of *a* increases five times during the development of the embryo from 16 to 27 mm. The increase in length from the floor of the nose to the mouth epithelium is due to the growth of *b* and *c*, which increase about 100 times.

Figure 3 demonstrates this point. In the upper drawing may be seen the old conception. In the beginning, the dental lamina is short. In the course of development, the lamina becomes longer and the distance *a* decreases. After the dental lamina has attained a certain length, the tooth germs develop. My point of view is shown by the lower diagram. The tooth germs (as my models demonstrate,) do not develop after the dental lamina has partially formed, but exist at the same time that the latter is just beginning to develop. Tooth germs and the dental lamina grow simultaneously, while the surrounding tissue grows centrifugally in the direction of the arrow. The deepest point of the tooth germs remains in its original place, so that the distance *a* remains the same.

Fig. 4.—Thickening of the epithelium of the mouth in the upper and lower jaws in an embryo of 16 mm. length. This thickening is the dental ledge and tooth germ. (× 80.)

Figures 4 and 5 are microphotographs of an embryo of 16 mm. length. In the first, a thickening at two points of the mouth epithelium may be seen. One is the dental lamina of the lower jaw, the other of the upper jaw. Higher magnification shows that, in this part of

the epithelium, cell division takes place, not only in the epithelium but also in the surrounding tissue.

It was interesting to study how root growth takes place after the crown has developed. It is generally held that Hertwig's epithelial sheath grows into the connective tissue and prepares the way for the developing root. It is believed that, in the development of the root, the epithelium has an active growth. I have just shown that, in the development of the tooth germs, there is no active inward growth taking place, and I maintain that no active growth of the epithelium of Hertwig's sheath precedes the development of the root.

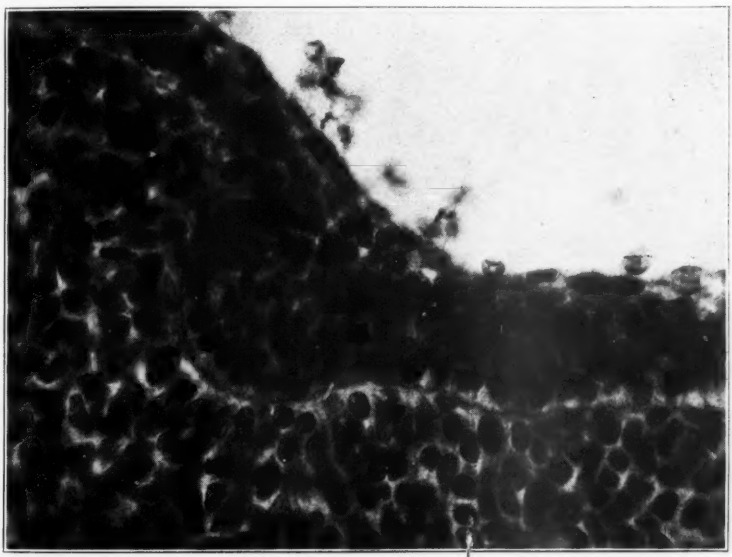


Fig. 5.—Higher magnification of the epithelium thickening shown in Figure 4 (lower jaw). Cell division takes place in the epithelium as well as in the connective tissue. (× 600.)

Figures 6-9 show that, as in the development of the dental ridge and tooth germs, the apices of the teeth keep the same distance from the floor of the nose at every stage of their development. Figure 6 shows the teeth of a child, aged 3. The apices of the deciduous teeth are about 2 mm. from the floor of the nose. The deepest point of the permanent teeth is somewhat nearer. Figure 7 is from a 4-year-old child. The crowns of the permanent incisors are developed, but as yet have no roots. The deepest point of these is about 1.5 mm. from the floor of the nose. In Figure 8, the teeth from an 8-year-old child are shown. The permanent incisors are just erupting, a part of their roots are built up and the deepest points of the roots are no nearer to the nose than in the earlier years. In Figure 9, all the erupted permanent teeth of a 10-year-old child can be seen. The deep-

est points of the roots are at the same distance from the floor of the nose as in the previous cases. Noyes, in his text-

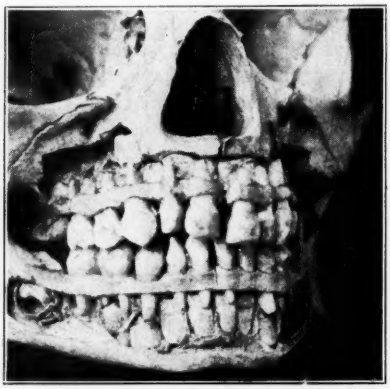


Fig. 6.—Skull of child, aged 3 years. The apices of the deciduous teeth are about 2 mm. from the floor of the nose.

book on dental histology (1921), describes the relationship in regard to the growth of the teeth and jaws similar to my preceding description, but from another point of view. Noyes makes no mention of Hertwig's epithelial sheath, which plays an important rôle in root development.

In résumé, Figure 10 demonstrates

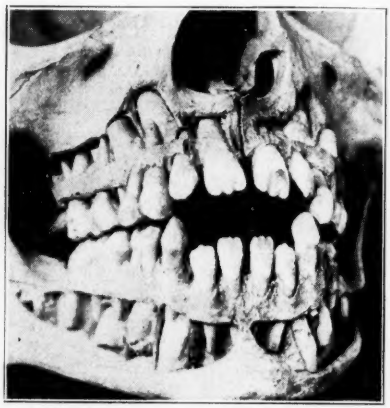


Fig. 8.—Skull of a child, aged 6 years. A part of the tooth roots is already built up. The deepest point of the roots is not any nearer to the nose than in the former cases.

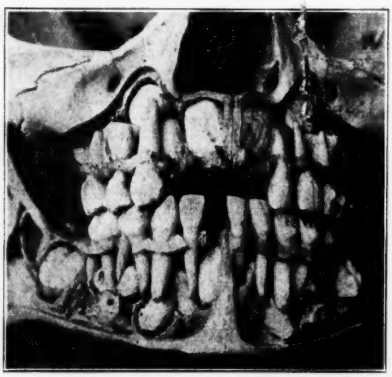


Fig. 7.—Skull of child, aged 4 years. The crowns of the permanent incisors are developed, but as yet have no roots. The deepest point of these is about 1.5 mm. from the floor of the nose.

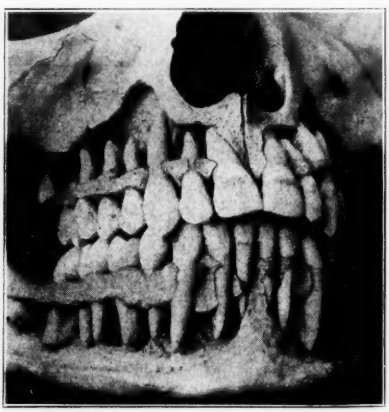


Fig. 9.—Skull of child, aged 10. The deepest points of the teeth (apices) are at the same distance from the floor of the nose as in the previous cases.

the development of the teeth and roots. At *1*, a tooth germ is to be seen. In Figure 1, it was noted that *a* is the distance from the floor of the nose to the deepest point of the teeth. In the second diagram, I demonstrated that this distance is about 1.5 mm. in the largest embryo measured. No. *2* (Fig. 10) shows a part of the crown already formed. In *3*, a part of the root is developed; in *4*, the root is about half grown, and in *5*, the whole tooth is formed. Thus, it may be seen that the deepest point of the teeth is at about the same distance from the floor of the nose at every stage of development. This distance does not, as a rule, become shorter; on the contrary, it grows somewhat longer.

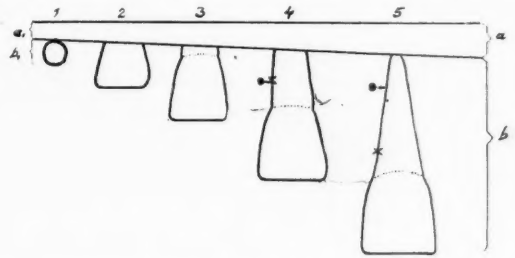


Fig. 10.—Development of the teeth and the roots. At *1*, a tooth germ is to be seen. *a-a*$_1$ is the distance from the floor of the nose to the deepest point of the teeth. At *2*, a part of the crown is already built up. At *3*, a part of the root is developed. At *4*, the root is about half grown, and at *5*, the whole tooth is already formed. The point indicated by the cross on the root in *4* and *5* moves in the direction of the mouth. The point in the bone indicated by a dot remains in its place.

In this diagram, *4* and *5* show that, in the course of development, the roots move forward inside their surrounding bone substance. The cross (×) on the root moves in the direction of the occlusal surface of the teeth, the dot (.) in the bone remains in its place. The bone of the alveolus is being built up by apposition on the margin. That this movement takes place can also be proved histologically. It is known that the incisors and also the molars of some rodents are constantly growing so that the teeth are continually moving forward inside their bony alveoli. Sicher has proved that the periodontal tissue of a permanently growing tooth consists of three layers: dentinal fibers, bone fibers and, between the two, *plexus intermedius*. This structure of the periodontal tissue is shown in Figure 11, which is taken from the incisor of a rat. This structure of the periodontal tissue is not only a characteristic of constantly growing teeth, but also can be observed wherever teeth move inside their bony alveoli. This phenomenon of the growing tooth germs may be noted in Figures 12-15. Figure 12 shows a tooth germ of a dog. The three different layers of fibers may be observed. The same structure of the periodontal tissue can be seen in the growing tooth germs of human beings. On a transverse section, I can demonstrate this. A higher magnification (Fig. 14) shows that, between the den-

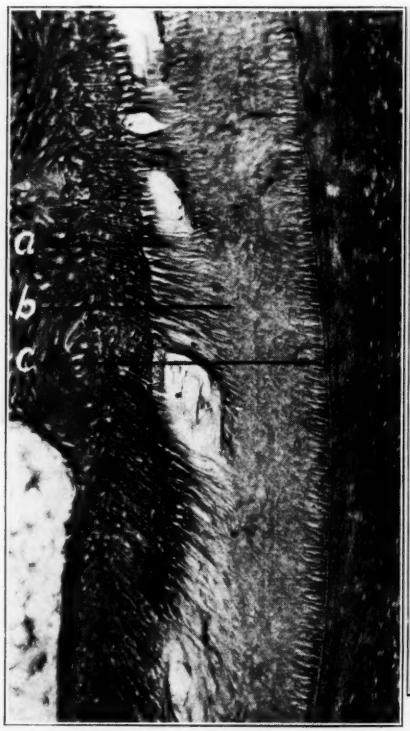


Fig. 11.—Periodontal membrane of the incisor of a rat; lingual side. Three layers are to be seen. *a*, bone fibers; *b*, plexus intermedius; *c*, dentinal fibers.

Fig. 12.—Periodontal tissues of a growing germ of a dog. The three layers of fibers are also to be seen (*a*, *b*, *c*). *d*, dentin; *e*, bone.

tinal fibers, there are the epithelial rests. The same may be seen on a sagittal section, as shown in Figure 15. This structure of the periodontal tissue is a characteristic of the movements of the teeth within their alveoli.

Knowing this fact, we must change our views respecting the generation of the epithelial rests, which arise from the epithelial sheath of Hertwig. Previously, it was assumed that the epithelial rests had originated so that the continuity of the epithelial sheath was interrupted by the invading connective tissue. This is not entirely correct. In the tooth development, the epithelial sheath of Hertwig is the fixed point from which the teeth are growing outward. The epithelial sheath attempts to follow the tooth in its outward growth (if such an expression may be used), but the cell division in the epithelial sheath proceeds more slowly than the growth of the teeth, whereby an incongruity of growth occurs. Through this disproportionate growth of the teeth and the epithelium, cells on the end of the epi-

thelial sheath lying toward the crown are torn off. These follow the teeth, and the epithelial rests result.

This procedure may be observed in Figures 16-20. Figure 16 shows the lingual side of an incisor of a rat, with the epithelial sheath of Hertwig. Different parts of this picture are shown in higher magnifications. In Figure 17, the loop of the epithelial sheath is to be seen built up by a double layer of cubelike epithelial cells. Figure 18 shows a part lying nearer the gnawing surface. Epithelial cells of the outer layer have lost their cubic shape and are longer. At the level of the dentin, the cells of both layers are longer and do not have the same regularity of form as before. Nearer the gingival surface, the double layer has disappeared, and isolated groups of epithelial cells are lying on the surface of the tooth as epithelial rests.

Fig. 13.—Cross-section showing the three layers of the periodontal membrane which can be seen in the growing tooth germs in human beings. *a*, bone; *b*, plexus intermedius; *c*, dentinal fibers; *d*, dentin.

SUMMARY

No inward growth of the epithelium into the connective tissue takes place either in the earliest stages of development or during the formation of the root. In the beginning of the develop-

ment of the tooth germs, the epithelium remains stationary in its original place while the surrounding tissues grow. During the development of the roots, the fixed point is the epithelial sheath of Hertwig and the growth of the teeth proceeds in the direction of the occlusal surface.

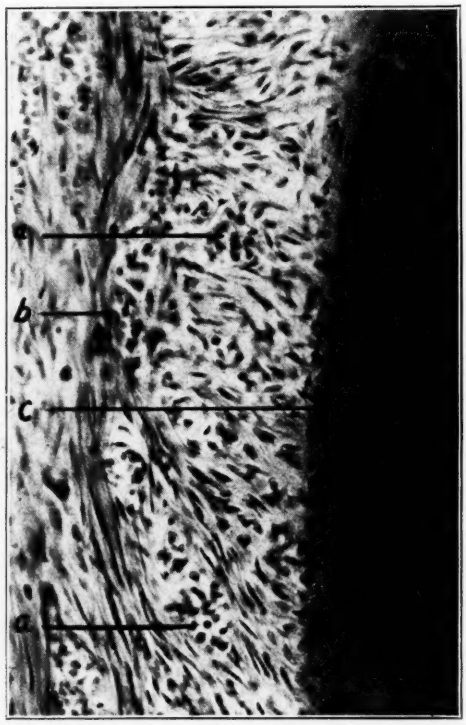


Fig. 14.—Higher magnification of the area shown in Figure 13. Between the dentinal fibers, are the epithelial rests. *a*, epithelial rests; *b*, plexus intermedius; *c*, dentin.

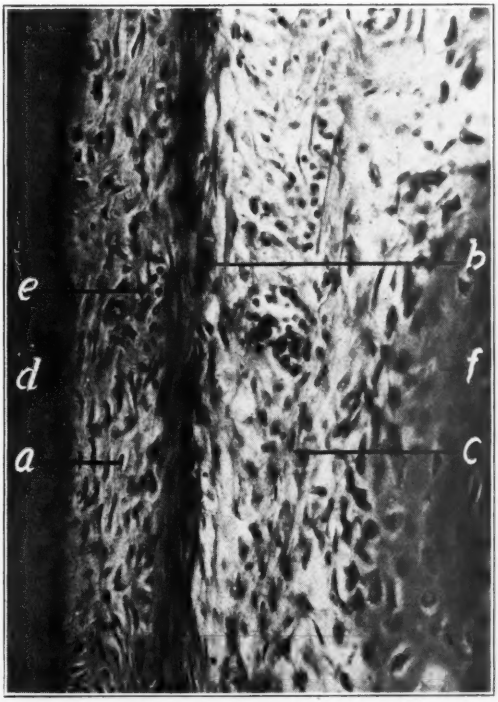


Fig. 15.—Sagittal section of a growing tooth germ (human). Three layers of fibers can be seen at *a*, *b* and *c*. *d*, dentin; *e*, epithelial rests; *f*, bone.

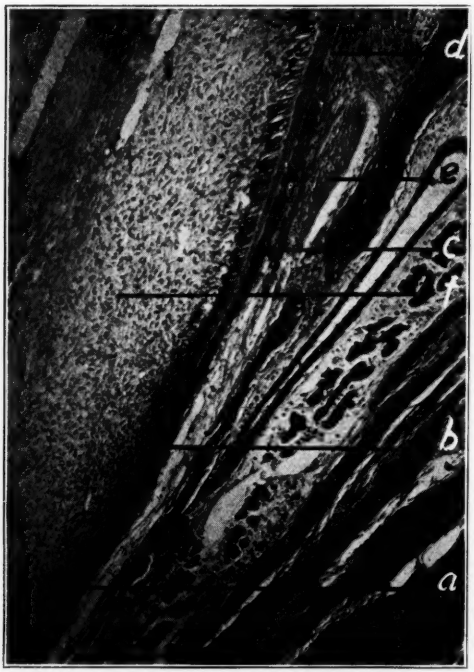


Fig. 16.—Epithelial sheath of Hertwig on the lingual side of the incisor of a rat. A higher magnification of *a*, *b*, *c* and *d* is shown in Figure 17. *e*, periodontal membrane; *f*, dentinal pulp.

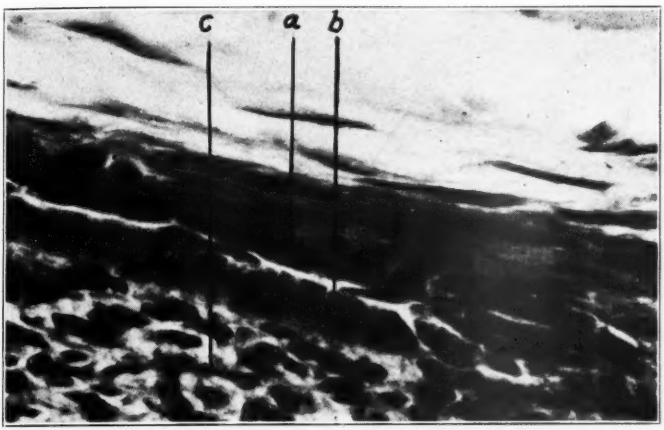


Fig. 17.—Loop of the epithelial sheath. We can see a double layer of cubelike epithelial cells. *a*, outer layer; *b*, inner layer; *c*, dentinal pulp. The area *a* is shown in Figure 16.

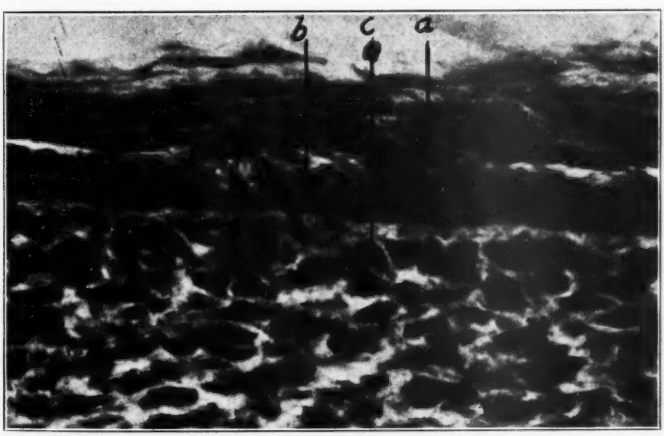


Fig. 18.—Area *c* from Figure 16. The epithelial cells of the outer layer have lost their cubic shape and are longer. At *c*, cell division in the odontoblast layer is evident.

Fig. 19.—The cells of the epithelial sheath are elongated in both layers. The cells do not hang together as regularly as before. *d*, dentin.

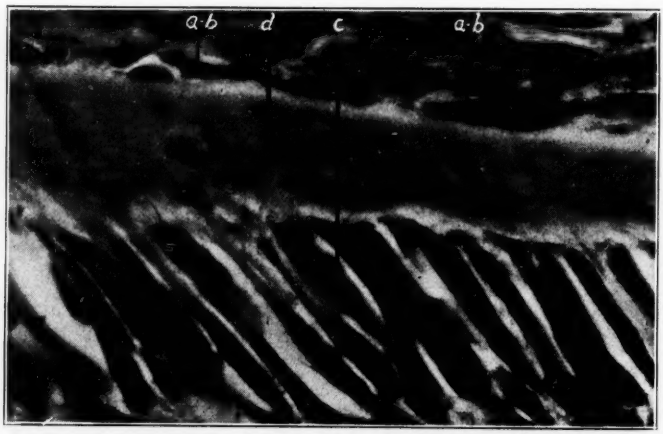


Fig. 20.—Cross-section in which only groups of epithelial cells (*a*, *b*) are lying on the surface of the tooth as epithelial rests, the double layer of the epithelial sheath having disappeared.

A CONSIDERATION OF SOME ASPECTS OF GINGIVITIS*

BY ROBERT A. KILDUFFE, A.M., M.D., Atlantic City, New Jersey

IT has always been true—but not always appreciated—that there is no part nor portion of the human body which can be separated so distinctly from all the other parts as to form an isolated mechanism capable of functioning without relation or regard to the multiple mechanisms which, as an interlocking whole, comprise the human machine.

It is impossible, therefore, for the specialist concerned primarily with any part or function of the human body, whether in health or disease, to regard himself or his particular province as utterly dissociated from all the other parts of the body; for the symptoms of disease as presented in one part, as evidenced by the alteration, disturbance or loss of function, far from being the disease itself, may be merely the final result of a long and complicated train of interrelated phenomena initiated in a very distant and not at all directly related place. Conversely, it may be relatively simple to recognize the primary focus of disease but another matter altogether to foretell the extent or the ramifications of the ultimate pathologic aftermath.

It is the realization of these fundamental and, indeed, elementary facts which has brought with it a realization of the fact that medicine and dentistry are related professions, the functions of each overlapping in the study of health and disease; and it is this realization which has focused so much attention in comparatively recent years on the relation of the teeth to local and systematic disease.

Progress in medicine is always a matter of evolution, and nearly every advance is hampered at the start by a tendency to overenthusiasm which sometimes leads to extremes. The history of every innovation is more or less the same: an initial impulse which very often leads to an excess of zeal, followed by a recoil to the other extreme and, finally, after the test of time and accumulated experience, to a resting of the pendulum in its appointed place.

In accordance with the formula thus expressed, we are gradually approaching a sane and consistent appreciation of the relation of the teeth to focal infection, and an appreciation of the avenues and methods of approach suited to an intelligent discussion of the question.

If a momentary digression from the subject may be permitted, something may logically be said in this place concerning the necessity for the utilization of all the available avenues of approach in the study of affections of the teeth—methods utilizable by both physician and dentist alike.

The patient approaching either the dentist or the physician does so primarily not because he knows his teeth are diseased or because he has a gastric ulcer, but because he has a toothache or a pain in his stomach. He comes, in other

*Read before the Atlantic County Dental Society, Atlantic City, N .J., March 8, 1928.

words, not simply because he is ill but because the manifestations of his illness are now such as to interfere with his accustomed habits of work or play; and, what is of great and often crucial importance, the symptom which drives him to seek relief may not be, and often is not, the underlying cause of the trouble. The gastric pain, for example, may be the end-result of digestive disturbances due, not to the condition of the stomach, but to passive congestion of the gastric plexus consequent on cardiac decompensation or hepatic cirrhosis; the toothache may be a referred symptom of sinus or nerve disease. Both dentist and physician must be on the alert, therefore, to discover more than the presenting evidence; the physician to look at the teeth and gums when he looks at the tonsils, and the dentist to look at the tonsils and sinuses when he looks at the teeth and gums.

It is of interest to recall, also, that the resources of the clinical laboratory are available to both; to remind both that lymphocytosis, for example, is an almost constant finding in apical infections, that the Wassermann test is often the answer to a puzzling syndrome and that the bacteriologic condition of the mouth is a matter requiring the most careful interpretation.

Returning to the subject, it is apparent that, despite the voluminous and at times acrimonious discussion which has raged around the combined picture presented by infections of the teeth and gums, commonly called pyorrhea, the subject is far from settled and neither the medical nor the dental profession is in accord, either each with the other or among themselves.

Etiologic conceptions and theories of treatment are widely at variance in both fields, and it is only since the realization that the problem is a joint one requiring the intelligent and combined attack of the internist, the dentist and the laboratory worker that some understanding of the subject appears probable.

It is customary in philosophic discussions, and the custom may well be carried into other fields, to clarify the situation by a preliminary definition of the subject matter, and some thought may well be given to a definition or an attempt to secure a definitive concept of the subject at hand.

Infection of the gums, in the minds of the laity certainly, in the minds of many physicians probably, and in the minds of some dentists possibly, means pyorrhea. This term, however, brings to mind at once a picture of purulent gums and tottering teeth, the dismal panorama of the ultimate result, and because of this relatively constant association of ideas, the term should be discarded; for, as Keilty[1] has well said, it would be just as logical to speak of tuberculosis only when there is cavitation as to speak only of pyorrhea, which, after all, is the ultimate result of previous disease.

Because of the prevalence of one type in particular of inflammatory disease of the gum during the World War, the term "trench mouth" has come into wide use, and also, because of the nature of the infecting organism, the expression "Vincent's angina of the gums" is frequently encountered.

A prerequisite to the understanding of any disease process is an understanding of its pathology, that is, a recognition of its cause and an appreciation of the mechanism whereby its phenomena are produced. All of the lesions evidenced

1. Keilty, R. A.: Present State of Our Knowledge of Gingivitis, J. Lab. & Clin. Med., 13: 5-451, 1928.

in the conditions know as pyorrhea, trench mouth, subperiosteal periostitis, subgingivitis, and so on, are, in essence, various stages or sequelae of a primary infection and consequent inflammatory process initiated in the gums. It seems logical, therefore, to discard all such terms in favor of the general term gingivitis, which may be defined as: "An acute, subacute or chronic inflammatory process in the gums and soft teeth investitures progressing, unless checked, to a periostitis and osteitis." (Keilty.) In accordance with the character of the lesions, and in the interest of exactitude, gingivitis may be described as acute ulcerative or suppurative, or chronic suppurative, chronic recessive, and so on.

Gingivitis, therefore, is a satisfactory, inclusive and pathologically accurate term because:

1. It implies the essential underlying character of the disease, an inflammatory process.

2. It implies, therefore, that it is infectious in origin.

3. It may be qualified to express the type and character of the lesions.

4. It is inclusive and so avoids confusion, redundancy or reduplication of terms.

The symptoms of gingivitis are extremely variable. In its early and minor stages, it may be entirely symptomless and, indeed, this is often the case. There is little doubt that minor degrees of gingivitis are present in almost 90 per cent of mouths, many of which are passed by, by both physician and dentist, as entirely normal; for it is exceedingly important to recognize the fact that gingivitis may be present without the presence of pus pockets or loose teeth—the common conception of the final stages recognized as pyorrhea. It is in this symptomless stage that the opportunity for prophylactic work is most favorably presented, and it is the failure to recognize the potentialities latent in these early stages of gingivitis which leads to the later production of often irreparable damage.

Pathologically, the signs of gingivitis —though they may vary greatly in degree—are redness, edema and surface granularity, progressing, if these warnings are neglected, to ulceration, suppuration, the establishment of deep gingival sulci and, in the terminal stages, to loss of teeth.

When of more than minor degree, the subjective symptoms of gingivitis are the familiar pain and tenderness of the gums and teeth, bleeding from the gums, and bad taste and foul breath, often due to the production of malodorous gases by gas-forming bacteria in the pus pockets.

So far, the picture is fairly distinct, but extraordinary difficulties are encountered in the discussion of the etiology of gingivitis; for while it is an infectious process, the contributing or predisposing causes, as well as the immediate bacterial causes, are the subject of a marked confusion of ideas.

It is, of course, obvious that the mouth is never a sterile cavity and that the structure of the teeth and gums is such as to furnish innumerable lurking places for bacteria, both aerobic and anerobic, and that there exist, also, all the requisites for luxuriant bacterial growth, namely, food, moisture and a favorable temperature.

Something more than the mere presence of bacteria is necessary, however, before infection occurs. The bacteria must invade or actually enter the tissues, and following their invasion and because of a lack of tissue resistance to their attack, there must be bacterial reproduction and the elaboration of bacterial

products capable of producing tissue damage.

As is well recognized, there are a variety of factors which, by the reduction of local and general resistance, may act as predisposing causes of gingivitis.

It is a matter of common knowledge that modern habits of diet have directly contributed to a lessening of the normal hardness of the gum. It is equally well recognized that the administration of certain drugs for various conditions may be a predisposing cause of gingivitis as well as those diseases which lower the patient's resistance in general, among which may be mentioned any prolonged illness or any acute infection, as well as such constitutional conditions as scurvy, rickets, syphilis, tuberculosis, acute interstitial nephritis, diabetes, anemia, pregnancy, lactation and so on, the important factor in many of these being their production of an extremely acid saliva.

It is, of course, unnecessary to call the attention of dentists to the important part played by pulpless or carious teeth, old roots and the mechanical strain of imperfectly fitted dental appliances.

All these factors are more or less familiar to both physician and dentist. What is not equally well-recognized, though of paramount importance, is the fact that gingivitis does not necessarily connote a dirty mouth or careless habits on the part of the patient. It is essentially a progressive disease, the beginnings of which are always minor and undoubtedly often overlooked. In the beginning, there is usually nothing more than a little redness on pressure, a little granularity here and there on the surface and, now and then, a shallow increase in the anatomic trenches. These are the mouths so frequently passed over as entirely normal.

Only the most careful search may reveal a little exudate, perhaps only about a crown or at the occlusal surfaces of molars, but, given time and opportunity, the starting point of a series of events progressing from redness and exudation to suppuration, ulceration, deepening of the trenches, the presence of pus pockets, ridging, atrophy, and recession of the gums, periosteal investiture and, finally, osteitis.

This initial, minor beginning may occur at any age or in either sex, in the cleanest of mouths, apparently, and in spite of the most meticulous habits of oral hygiene.

In fact, paradoxical as it may seem, excessive or ill-advised zeal on the part of the patient may perpetuate and extend the primary condition. The too vigorous use of dental floss, for example, the thread passing through a septic area and, when thoroughly impregnated with bacteria, passing then to a healthy area and, perhaps, transplanting bacteria by means of minute cuts and abrasions, is a procedure not without dangerous potentialities; and how many patients consider the potentialities of the toothbrush, not the possibility of producing tissue damage by excoriation or abrasion of the gums, but the fact that it is literally a septic sink? Once used, every toothbrush is a massive storehouse of bacteria, and, unfortunately, there are none whose structure permits repeated sterilization without rapid destruction.

The observation of Reasoner and Gill[2] that ordinary soap lather has a definite bacterial and spirochetocidal property suggests that toothbrushes may be kept relatively clean, and certainly cleaner than they usually are, by immer-

2. Reasoner, M. A., and Gill, W. D.: Use of Soap in the Prophylaxis of Vincent's Infections, J.A.M.A., 88: 716 (March 5) 1927.

sion in soapy water or, perhaps, better, by impregnating them thoroughly with soap lather before placing them in a rack.

Bearing in mind that almost 90 per cent of mouths are the seat of potential gingivitis, it must be remembered that the injudicious use of the scaler, especially when accompanied by injury to the gums, may not only clean the teeth of accumulated tartar and mucinous plaques but, at the same time, expose new and freshly abraded surfaces to infection.

From what has been said, it is apparent that (1) almost 90 per cent of mouths are the seat of potential gingivitis, and (2) the number and variety of predisposing causes are legion.

Still more is this true of the immediate bacterial causes of gingivitis.

All are agreed that gingivitis is an infection, but discussions as to the kind of infection are almost endless and, perhaps, the only common point of agreement is that it is a mixed infection in which a variety of organisms are concerned, some of which are undoubtedly more frequently involved than others.

The literature concerning the bacterial flora of the mouth is extraordinarily voluminous and involves a vast number of bacterial species. This much is relatively certain: 1. The gingival sulci and the crevices between the teeth in the normal mouth contain relatively few bacteria and these of little or no importance in relation to gingivitis. 2. The bacterial flora in gingivitis is extremely varied. 3. There is a certain rather characteristic constancy in the bacterial flora, as far as the predominating organisms are concerned, which renders possible a tentative separation of gingivitis into certain types, which is of some practical value as concerns treatment.

The studies of the bacteriology of gingivitis are almost innumerable. Perhaps the most recent, as well as one of the most extensive and systematic, is that reported by Keilty,[1] covering a series of 4,347 individual cases in which the gingivae were examined bacteriologically by smear, dark-field, culture or section.

The incidence of definite types of organisms in his series was as follows: spirochetes (spironemata) and fusiform bacilli, 96.4 per cent; *Endameba gingivalis,* 71.6 per cent; mixed bacterial flora, including streptococci, anerobes, and gas and acid forming bacteria, 66.6 per cent.

These three groups, alone or in combination, are believed to be of paramount importance in the production and perpetuation of gingivitis, the bacterial flora being naturally more diverse and more complicated as the lesions progress but always presenting a recognizable picture of species predominance.

Endameba gingivalis, first described by Smith and Barrett[3] and later studied by others, including Bass and Johns,[4] Sandford and New,[5] Hecker,[6] Keilty,[7] Mitchell, Culpepper and Ayers[8] and

3. Smith, A. J., and Barrett, M. T.: Parasite of Oral Endamebiasis, Science, 42: 354, 1915.

4. Bass, C. C., and Johns, F. M.: Pyorrhea Dentalis and Alveolaris, J.A.M.A., 64: 553, 1915.

5. Sandford, A. H., and New, G. B.: Relation of Amebiasis to Pyorrhea Alveolaris, Surg. Gynec. & Obstet., 22: 27, 1916.

6. Hecker, F.: Experimental Studies with Endameba Gros, J. Infect. Dis., 19: 729, 1916.

7. Keilty, R. A.: Focal Infection, J. M. Res., 43: 377-385 (Aug.-Oct.) 1922.

8. Mitchell, O. W. H.; Culpepper, W. L., and Ayer, W. D.: Endameba Buccalis in Institutional Children, J. M. Res., 35: 51, 1916.

Fisher,[9] has been the subject of much, and far from unanimous, discussion.

While it is generally acknowledged that *Endameba gingivalis* does not constitute a single, specific cause of gingivitis, although this is disputed by Bass and Johns and by Keilty, who believe that it may be the specific cause of a particular type of the disease, there is definite evidence to warrant the assumption that they may, by reason of mechanical factors and traumatic stimuli, play a definitely contributing part.

Until this assumption can be definitely disproved, their presence in large numbers warrants consideration in the treatment of the disease.

The most important of the bacterial forms are the streptococci, because they possess the property of invading tissues and are thus of real danger as the focal agents of systemic, metastatic infection, and the spirochetes and fusiform bacilli of Vincent.

The most important streptococcus is *Streptococcus viridans,* of which there are several types *(mitis, salivarius* and *fecalis),* according to Holman's[10] classification, which, though open to criticism, serves the purpose of this discussion. Neither time nor space permits any discussion here of the undoubted and important relation of these organisms to metastatic infection.

The spirochetes and fusiform bacilli, first described by Plaut[11] and Vincent,[12] are of undoubted and extreme importance in relation to gingivitis. These organisms, which are generally, though not always, seen in association, are the subject of much discussion among bacteriologists.

The majority have regarded this association as a matter of symbiosis. Tunnicliff[13] has brought some very suggestive evidence that these two forms are but different stages in the life cycle of a single organism, a higher leptothrix; and though this conclusion is not yet generally accepted, there is much evidence in its favor and there is a strong probability that it is true.

It is of some practical importance to note that these spirochetes, or, more properly, spironemata, have nothing in common with *Spirocheta pallida,* the cause of syphilis. They are not associated with nor related to syphilis in any way, except as secondary invaders in a mercurial stomatitis resulting from antisyphilitic treatment, and do not of themselves produce a positive Wassermann reaction. This seems worthy of mention because patients have been unduly alarmed and apprehensive of syphilis when told of the presence of spirochetes in oral exudates and, occasionally, are referred for a Wassermann test for the same reason.

Some authorities have been inclined to decry the relation of these organisms to gingivitis because they are to be found in a large proportion of mouths. It suffices to recall what has been said previously of the presence of minor grades of gingivitis and of gingivitis *in potentia* in mouths frequently regarded as normal, and to emphasize that these organisms are strikingly characterized as opportunists, that when they do cause infection it is in locations where they are

9. Fisher, J. H.: Pyorrhea Alveolaris: Rôle of Certain Organisms Found in the Lesions, Am. J. Pathol., 3: 169 (March) 1927.

10. Holman, W. L.: Classification of Streptococci, J. M. Res., 34: 377, 1916.

11. Plaut: Deutsch. Med. Wchnschr., Vol. 49, 1894.

12. Vincent: Ann. de l'Inst. Pasteur, 1896.

13. Tunnicliff, Ruth: Life Cycle of B. Fusiformis, J. Infect. Dis., 33: 147 (Aug.) 1927.

normally found or from which they may be transplanted to the lesions produced, and that they are prone to take advantage of changes in tissue resistance, however provoked.

While their rôle as the primary etiologic factor in the production of disease may be disputed at times, there is no question that, when they are secondary invaders, they frequently dominate the pathologic picture produced and so become of preeminent importance.

It is evident from the foregoing that there is no single, specific cause of gingivitis and, therefore, that there can be no single method of treatment. As, however, the success of therapeutic measures has been shown to be definitely influenced by the type of infection, a brief résumé of the diagnostic methods of value is of interest.

First of all comes the general survey, not merely for the grossly evident lesions, but for those which will be found only by careful inspection and search.

When suspicious areas are found, specimens must be secured for microscopic examination. Cultures are not required as a rule and, indeed, may fail of their purpose unless the pathologist is informed as to the nature of the case; for the organisms of Vincent are strict anerobes and will not grow under the aerobic conditions usually employed. Unless the dentist is prepared to make his own examinations, the patient should be sent to the laboratory for the collection of the specimen. Study of the stained smear or a dark-field examination usually suffices.

The specimen is best secured with the ordinary inoculating loop of the bacteriologic laboratory, which should be made of 22 gage chrome wire, platinum being too soft. Instruments are too stiff. The procedure should be gentle, both to minimize pain and to avoid hemorrhage, which obscures the microscopic field. The wire should be flamed before its initial insertion in the mouth but need not be afterwards because a transfer from one pocket to another is of no significance.

The method adopted by Keilty,[1] which can hardly be improved on, is as follows:

After a survey of the entire gingivae, the gums are exposed with a moistened wooden tongue depressor, and material is obtained from all possible sources in the gingival sulci, the loop being worked in and out where the gingival trench is deep. The material so obtained is transferred to a large drop of physiologic solution of sodium chlorid on a warm microscopic slide and covered with a coverslip and examined with the high (4 mm.) dry power objective.

As an alternative, the material may be mixed with about 0.5 c.c. of physiologic solution of sodium chlorid in a small tube and kept warm until a smear can be made for examination; or several smears may be made of the mixed material emulsified in the saline solution, dried, fixed and stained with Loeffler's methylene blue, weak carbol-fuchsin or Gram's stain.

The features to be looked for and reported in relative terms of their number (plus one to plus four, for example) are: spirochetes and fusiform bacilli, endamebae, bacteria as a group, cocci and bacilli, pus and blood cells, desquamated epithelium and mycelial threads. Whatever is seen should be reported. Cultures are hardly required unless in obstinate cases or those in which the use of a vaccine is contemplated.

With such a method, the cases will be susceptible of classification, in accordance with the predominant picture, into

four groups: (1) fusospirochetal, (2) streptococcal, (3) mixed bacterial flora, and (4) endamebic.

While, as has been said, there is no single, satisfactory method of treatment, that to be used at the start is influenced to some degree by the microscopic picture of the infection, and certain principles may be laid down.

First, all possible etiologic data should be secured and considered; for successful treatment is only possible through a mass attack using every available method against the conditions in each individual mouth.

Cavities must be filled, improperly adjusted mechanical appliances corrected and gross collections of tartar and calculus removed, if they are traumatic stimuli. Indiscriminate and energetic scaling and the extensive use of polishers and so on which lead to trauma and damage are to be condemned as more likely to do harm and extend infection than to aid in its control or eradication; for injury to teeth leads to caries, and injury to soft tissues merely opens new avenues for invasion.

Radical surgical procedure such as extensive trimming or excision of the gum warrants vigorous condemnation. It merely produces in a moment what the disease may take years to accomplish—extensive exposure to the dentin; leads to extreme recession of the gums, and produces the best possible situation for metastatic implantation, local and systemic.

The use of strongly escharotic agents, so commonly noted among the infinite variety of therapeutic measures, such as strong copper sulphate or silver nitrate solutions, these chemicals in crystal form, or strong chromic acid solutions and so on, are equally to be condemned; for their predominant action is the destruction of tissue and they therefore simply anticipate the final stage of the disease.

Hydrogen peroxid and sodium perborate have their adherents but may be objected to, (1) because of the acid reaction of the former; (2) because, while it is true that Vincent's organisms are anaerobes, the evolution of oxygen by these agents is too evanescent to hamper their growth, and (3) because their vigorous gaseous ebullition may serve to open up new loci for invasion. They may be of some use as temporary agents for gross cleaning prior to local measures although it may be suggested that, because of its bactericidal and spirocheticidal action as shown by the work of Reasoner and Gill, already referred to, soap lather or a wash of 1 per cent soap solution is not only appropriate and harmless but also beneficial.

In the last analysis, successful treatment depends on these factors: 1. The adjustment of chemotherapy to the bacteriology of the infection. 2. Meticulous attention to detail, on the part of the patient as well as the dentist. 3. Frequent bacteriologic control with variations in chemotherapy as indicated. 4. Patience and persistence.

The type of chemotherapy indicated is only to be ascertained by bacteriologic examination, to determine not merely the kind of organisms present but also those which dominate the picture.

In those cases in which *Endameba gingivalis* is predominant, Evans and Middleton,[14] as well as others, advocate the local use of 0.5 per cent emetin hydrochlorid and, in severe cases, its administration subcutaneously in a dose of one-eighth grain daily for eight days.

14. Evans, J. S., and Middleton, W. S.: Endamebic Pyorrhea, J.A.M.A., 64: 422, 1915.

But as these cases are so infrequently encountered and there is some possibility of toxic reactions from subcutaneous injections, attention may well be directed first to the bacillary type.

In those cases in which the fusiform bacilli and spirochetes predominate, the arsenicals are the drugs of choice and are of preeminent value. Their intravenous injection is only warranted when the infection is so intensive and extensive as to produce a febrile reaction and profound depression; it can never replace local applications, which are the means of choice and are most promising of success.

Because of the extremely varied flora always present regardless of the predominating type, and because the mechanism of the disease is complex and to some extent symbiotic, the combination of the arsenicals with some bactericidal agent is advisable.

Such a combination is easily made by drawing into a syringe equal parts of arsenical solution and 1:500 mercurophen or metaphen solution, as suggested by Kolmer.[15]

Arsphenamin may be used in the following formula:

Arsphenamin	0.3 gm.
Hot 50 per cent glucose solution	15 c.c.
Glycerin	15 c.c.

This solution is efficacious until it turns a deep black-green from oxidation.

Neoarsphenamin, 0.9 gm., may be dissolved in cold sterile 50 per cent solution of glucose, 22.5 c.c., making a 4 per cent solution, which is good until deeply oxidized; or the powder may be made into a thick paste with water or glycerin and directly applied to the infected areas and pockets.

15. Kolmer, J. A.: Chemotherapy, Philadelphia: W. B. Saunders Company, Ed. 1, p. 365, 1927.

It is important to remember that these drugs must be carefully introduced into every crevice, trench, pocket and lurking place of the organisms and to remember that the drugs are diluted in a very few minutes by saliva and washed away. Until some method of incorporating them into some relatively stable jelly or paste can be devised, this means a protracted and arduous session for both dentist and patient; but nothing else suffices.

The frequency of treatment varies with each case. Some must be seen at least twice daily, others daily until the acute flare-up is under control. Some may clear up promptly and others require treatment for months.

The active cooperation of the patient is essential. At least three times a day, and especially after meals, the mouth must be washed thoroughly with, perhaps, 1 per cent soap solution followed by lukewarm water or some pleasant wash, and then a bactericidal tooth paste should be applied, preferably with the fingers, and worked into every possible crevice with gentle massage. It should be allowed to remain there for at least from three to five minutes and then rinsed away. The following formula is suitable and, though toxic, is not harmful in the minute amounts which are likely to be swallowed:

Toothpaste (any good paste of alkaline reaction)	100 gm.
Mercurophen (or metaphen)	0.5 gm.

This formula is suited for the treatment of the active case. When used as a prophylactic, the amount of mercurophen or metaphen may be reduced to 0.1 or 0.2 gm.

Every patient should be thoroughly informed on two points: (1) that gingivitis, as seen in the dentist's office, is not a newly acquired condition but a flare-up of a preexisting disease, and that, while

it can, by constant effort, be kept under control, it can never be entirely eradicated, and (2) that control, not cure, constitutes therapeutic success. Recurrences are common and, with neglect, inevitable.

Radical procedures in the treatment of gingivitis are inadvisable, harmful and to be condemned, other than an incision of a pocket which is really a sinus, to facilitate drainage.

The important thing is not so much what is done or used but how it is used, and what to use depends on frequent bacteriologic control. Once the acute condition is controlled, whatever is required to minimize trauma and prevent the perpetuation of local foci should be done.

In the extremely obstinate cases, Briggs[16] suggests the local use of autogenous vaccines prepared after a special method. A mixture is made of a suspension of the isolated bacteria. One-half the volume of this mixed suspension is treated with one-tenth the volume of 10 per cent sodium hydroxid for 24 hours at 37 C. and the solution is then neutralized with hydrochloric acid. One-quarter of the remaining half of the original suspension is sterilized by heat (60 C. for one hour), and the remaining quarter by formalin (40 per cent solution of formaldehyd), 1 per cent for twenty-four hours. These last two portions are then suspended in the first neutralized solution, and 0.5 per cent of phenol is added and the suspension standardized to contain 20,000 million bacteria per cubic centimeter. The dose is one drop or 0.05 c.c and contains approximately 1,000,000,000 bacteria per cubic centimeter.

16. Briggs, H. F.: Local Vaccine Treatment of Pyorrhea, Brit. M. J., 1: 316 (Feb. 23) 1924.

The method is thus described by Briggs:

The injections are made by inserting the needle superficially into the reflection of the mucous membrane, above the apices of the bicuspids, or canines. Care should be taken that the needle does not penetrate too deeply; its orifice should be just covered by the mucous membrane; the most convenient syringe is one graduated to deliver drops of the dimension described (0.05 c.cm.), which must be carefully sterilized for use. A course of treatment consists of ten to twelve injections, given at intervals of not less than forty-eight hours nor greater than eight days. The only exception to this is that between the first and second injections a period of four days must elapse. The course will thus occupy about twenty-two days, the last five injections being of six drops each. The accompanying table is of use.

BRIGGS' TABLE

Day	Drops	Places	Day	Drops	Places
1st	1	1	12th	6	2 or 3
4th	2	1	14th	6	2 or 3
6th	3	2	16th	6	2 or 3
8th	4	2	18th	6	2 or 3
10th	5	2	20th	6	2 or 3

After the two-drops injections, I inject each dose in two or three places of the mucous membrane, thus obtaining the maximum activity whilst modifying the local reaction. No departure from these directions must be made; for instance, giving three drops after one drop would do harm and not good by bringing on a prolonged negative phase. If a reaction takes place all symptoms must disappear before the next dose is given, then the dose which caused the reaction should be repeated. Local treatment is absolutely essential, and must be carried on concurrently with the vaccine injections. Worthless and septic roots may be extracted after the third or fourth sitting. A mouth wash of salt (1 drachm to 8 ounces of water) should be prescribed, and also a simple tooth powder, such as precipitated or camphorated chalk. Soap must not be used.

This method awaits confirmation.

The essential thing is to remember that gingivitis is a chronic disease of long duration, the treatment of which depends on a careful consideration of all

contributory factors present in a given case and their complete correction; that with this, and local chemotherapeutic treatment giving attention to proper concentration and amount, and with proper technic, the problem of gingivitis, difficult and complex though it be, may be to a large extent solved. The acute condition can be stamped out and the chronic stages effectually controlled by appropriate measures intelligently applied.

IMPRESSIONS FOR FULL DENTURES*

By ELBERT C. PENDLETON, D.D.S., Chicago, Illinois

THERE is one step in the technic of full denture construction which stands out as paramount in successful practice. By virtue of its sequence, impression taking demands vital interest. Impressions, the negatives from which casts are made, are the foundation of our finished dentures.

Foundation is a far-reaching term as applied to impressions in full denture construction. It implies good judgment on the part of the operator, and it is one of the great factors in success. The possession or the lack of this intuitive power of determining the best plan of procedure may mean failure, on the one hand, or success, on the other. We should, as far as possible, anticipate every requirement that may be made of the finished denture, and work out a plan to satisfy every demand that could possibly be made under the most exacting circumstances. Therefore, in order to be able to say that we have an adequate impression, we first must develop a mental picture of the finished result and have a definite idea as to the demands that are to be made on the tissues covered by the denture base. Great care should be exercised in the examination of the areas to be covered by the denture base. For the purpose of description the maxillary area is divided into (Fig. 1), (1) the relief area; (2) the stress bearing area, and (3) the valve producing area. The areas of relief are those upon which great stress must not be exerted by the pressure of the mandibular upon the maxillary denture in the process of mastication. They are the raphe or maxillary suture and the anterior and posterior palatine foramina carrying the blood and nerve supply to the tissues that are to sustain the denture base. The stress bearing area, which must sustain the load, embraces the alveolar ridges and all of the hard palate, except the areas of relief. The valve producing area is the area where a seal is established to prevent ingress of air and which extends from the attachment of the labial and buccal peripheral muscles on to the border tissue as far as the muscle roll. This area also includes the post-dam area, which extends from one tuberosity to the other and from the union of the hard and soft palate as far as this tissue will tolerate the extension of the denture base.

*Read before the Chicago Dental Society, Nov. 15, 1927.

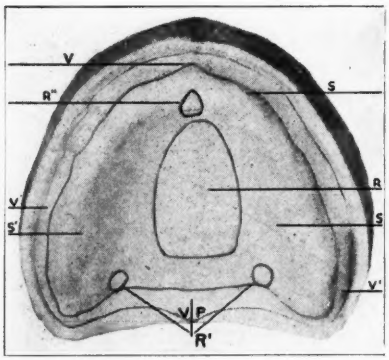


Fig. 1.—Cast showing: relief areas: *R*, raphe; *R*,' posterior palatine foramina; *R*," anterior palatine foramina; stress bearing area: *S*, alveolar ridge; *S*,' *S*," hard palate; valve producing area: *V*, labial and buccal valve area; *V P*, post-dam.

The mandibular area is divided into (Fig. 2) (1) the stress bearing, and (2) the valve producing area. The stress bearing area includes the alveolar ridge to the point of peripheral tissue attachment, buccally and labially, and to the point of attachment of the muscles of the tongue, the floor of the mouth and the pharynx on the lingual surface. The valve producing area begins at the junction of the peripheral muscle attachment with the labial and buccal surfaces of the alveolar ridge and includes that area on the crest of the mandibular ridge described as the retromolar triangle, which is the post-dam area. Lingually to the ridge, the valve area extends from a point of the attachment of the muscles down as far as the roll of these muscles. The line of extension of the lingual flanges can best be developed by muscle action during the operation of development of the mandibular impression tray. By the above mentioned roll of the muscle, we mean the point to which the periphery of the denture bases can be extended, without interfering with the free movement of these muscles, or to a point where the encroachment of the denture base upon these muscles would result in the subsequent loss of tissue tone, owing to an interference with the

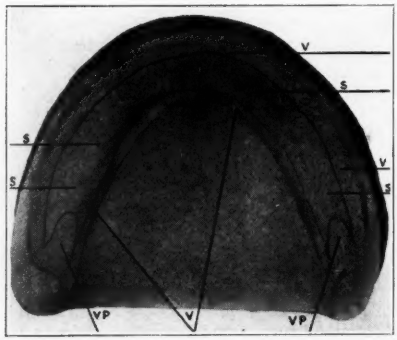


Fig. 2.—Mandibular cast showing *S*, stress bearing area; *V*, valve area; *V P*, post-dam.

Fig. 3.—Maxillary metal tray trimmed and contoured.

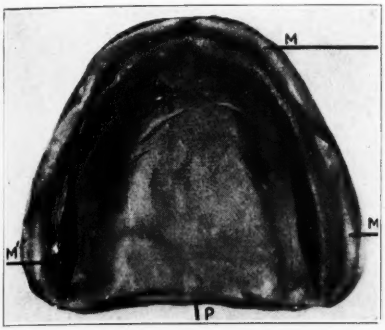
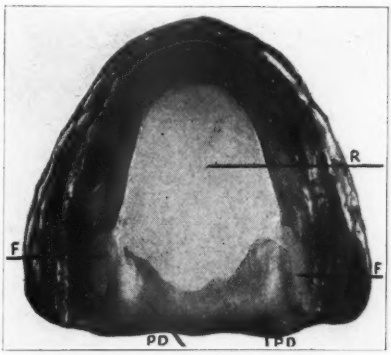


Fig. 4.—Maxillary individual impression tray, first treatment. *M*, labial muscle roll; *M*,' buccal muscle roll; *P*, posterior palatal border.



Fg. 5.—Maxillary individual impression tray. *P D*, post-dam; *R*, relief over maxillary raphe; *F*, relief over posterior palatine foramina.

nutrition, blood supply and normal function of the glands beneath these structures.

It is an excellent plan to outline, with an indelible pencil, the areas of relief, as well as the attachment of the peripheral muscle tissue, before beginning the operation of impression taking. This plan gives the operator a definite diagram of the field. As soon as the location and extent of the relief areas and the line of attachment of the muscles have been determined, the lines may be erased with a piece of dry gauze. There will be, in most cases, a sufficient amount of secretion from the palatine glands to supply moisture for removing tracings. If not, it is best slightly to moisten the gauze swab. By so developing our plan of operation, a definite purpose is established.

An individual impression tray is prepared from impression tray compound. The technic used in forming the individual tray will so control the compression of those areas of the vault which are underlaid with submucosa of varying thickness and tone as to produce a well adapted impression tray for each case. By careful technic, it is possible to obtain impressions that will sustain full dentures with comfort and satisfaction. We now have established the areas in accordance with the fundamental principles of denture retention, namely areal contact, extension for retention and peripheral bearing with freedom of muscle action. These principles should be kept in mind while developing a technic for taking the impressions.

Carding wax is recommended for the control of the compressible areas of the post-dam.

The peripheral valve seal and the fine detail are secured in a wash of plaster of Paris. The technic used for mixing plaster of Paris, which I shall describe later, gives us a material which is very hard and practically free from air bells, and does not adhere to the vault. It is, by virtue of its qualities, a new material, as far as impressions are concerned. We believe that this technic will lift the embargo on the plaster wash.

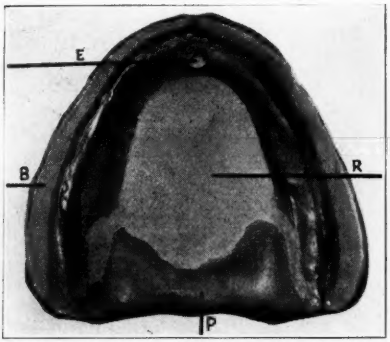


Fig. 6.—Maxillary individual impression tray completed to receive final correction. *E*, escape over anterior palatine foramen; *B*, bevel; *P*, post-dam; *R*, relief.

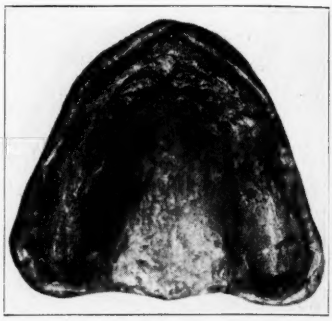


Fig. 7.—Corrected maxillary impression.

The virtues of plaster of Paris as an impression material are too well known for discussion, although there have been disadvantages which we now believe may be attributed to the technic employed in its manipulation.

A suitable metal tray should be selected. The metal tray should be polished to facilitate the easy removal of the impression tray compound. Also, the polished tray has a psychologic effect on the patient, which should not be overlooked.

For a maxillary case it may be necessary to trim the rims to a point which will permit of free movement of the peripheral muscles. (Fig. 3.) The posterior palatal portion should be contoured to the shape of the vault tissues. This may best be accomplished with a pair of "Crescent" contouring pliers. By shaping the posterior palatal portion so that it follows the contour of the soft tissues of the palate, we obviate the danger of having an impression tray that is of insufficient length anteroposteriorly. The mandibular metal tray should be carefully adjusted to insure adequate material for the development of the individual impression tray. Undercuts that would interfere with separating the individual impression tray from the metal tray should be avoided. Great care should be exercised in adjusting the posterior buccal rims and lingual flanges. The correct adaptation of the tray to the alveolar ridge has much to do with success in taking mandibular impressions.

Two blanks of impression tray compound placed in water heated to from 160 to 170 F. will provide sufficient material for developing a maxillary individual impression tray. The metal tray should be heated slightly before adapting the impression tray compound. This causes the impression tray compound to adhere to the metal tray and later facilitates the separation of the two. The impression tray compound should be thoroughly kneaded in the palm of the hand to insure uniform consistency. It should then be molded to a level with the rim of the metal tray and inverted over a low flame until the surface is superheated, immersed quickly in warm water and carried to the patient's mouth, care being taken that the metal tray is

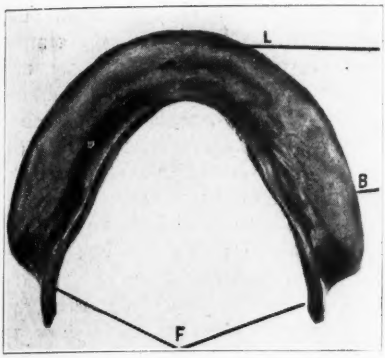


Fig. 8.—Mandibular individual impression tray trimmed of excess. *F*, lingual flanges; *B*, buccal roll; *L*, labial roll.

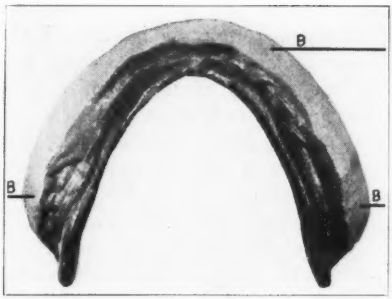


Fig. 9.—Mandibular individual tray showing completed treatment. *B*, bevel of buccal and labial rims.

properly centered. One should avoid "rushing" the maxillary impression. The tray should be removed from the mouth and examined for wrinkles. Both care and deliberation are very necessary to the proper development of the individual impression trays. If the operator is satisfied with the first negative, the tray should be replaced in the mouth and sustained in position with one hand while, with the other, the tissues are pulled down over the labial and buccal rims. The labial and buccal muscle attachments in the valve producing area should be plainly marked; also the relief and stress bearing areas should be clearly defined. If these requirements are not met by the first negative, the tray should be chilled in cold water, wiped dry, carefully reheated over a low flame, immersed in warm water to temper and adapted in the mouth. The third finger of the left hand is placed near the palatal border of the metal tray; the patient is instructed to pull the upper lip down as far as possible, and then, with the right hand, the operator commences a gentle pumping motion on the handle of the tray. By this technic, the compression of the soft tissues is controlled to a point at which the patient can comfortably tolerate it. The material is removed from the mouth and chilled. The operator should cut away any impression tray compound that overlaps the rim of the metal tray and would thus interfere with their separation. (Fig. 4.) The handle of the metal tray may be tapped with a horn mallet and the two will readily separate. The operator must carefully study the negative to see that every detail is developed. If it is satisfactory, a line is marked, designating the height of the labial and buccal portion of the rims; that is, a point which would denote the roll of the muscle. The extension of the posterior palatal border is likewise noted and, with a sharp knife, any excess in the length is removed. The rims should be reduced from 1 to 3 mm. below the line which marks the roll of the muscle, to assure no encroachment on the muscles. The compression of the soft palate or the development of the post-dam is next in order. (Fig. 5.) Carding wax is added to the posterior

palatal border of the individual impression tray from the attachment of the pterygomandibular ligament on the one side to that of the opposite side. Carding wax is best applied with an artist's small brush after the wax has been placed in a small container and melted over a flame. It is most practical to add a layer equal in thickness to a piece of blotting paper. After the impression tray is moistened in warm water and inserted in the mouth, the patient is instructed to close and swallow. Carding wax flows at body temperature and will mold to adaptation of the raised position of the soft palate as the act of swallowing elevates the muscles. This procedure definitely marks the posterior extent to which the impression should be developed to insure retention of the finished denture.

Impression compound may also be used quite successfully instead of carding wax, but the operator is more liable to overcompress the structures of the soft palate.

A post-dam that is too thick may act in two ways: It may interfere with the proper seating of the individual impression tray when the wash of plaster of Paris is inserted, causing undue impingement of the individual tray along some portion buccal to the alveolar ridge. Again, if the tone of the tissues of the soft palate is very tense, the overcompression may act as a lever, and the finished denture will lack retention.

We now have a maxillary individual impression tray that has been prepared to secure perfect adaptation over the region of the mouth described as the stress bearing area. The post-dam was completed with carding wax to insure comfortable adaptation and adequate extension of the posterior palatal border. The buccal and labial rims have been developed with the central thought of going as far as we can without going too far. This is drawing rather a fine line, but there is more danger in overextension than lack of extension. Overextension invariably means lack of adaptation. To secure both extension and adaptation, the valve producing area can best be developed in plaster of Paris.

When the individual impression tray is developed, every effort is made to control the compression of the soft tissues to a minimum. It is recommended that the individual impression tray be reduced, over the relief areas in order to insure further against encroaching upon these relief areas and to cause the stress of mastication to be borne chiefly by the alveolar ridges. This precautionary measure provides for the development of the completed impression of the relief areas in plaster of Paris.

An escape is necessary to avoid overcompression with the plaster wash. To insure against overcompression, a hole, 3 mm. in diameter, is cut through the individual impression tray at a point lingual to the crest of the anterior ridge in the region of the anterior palatine foramen.

The valve producing area of the corrected impression, taken in plaster of Paris, must be of sufficient volume to allow the buccal and labial tissues to drape themselves into the soft material. To insure sufficient bulk of plaster of Paris, the buccal and labial rims are beveled. (Fig. 6.)

With a sharp knife, a bevel is produced, varying in length from 5 to 7 mm. along the inner crest of the rim of the individual impression tray. This bevel is extended from tuberosity to

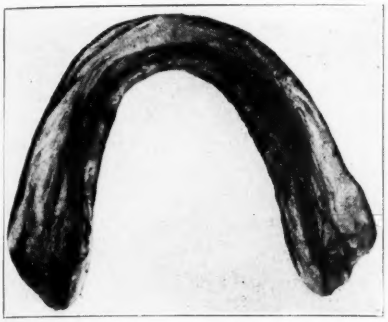


Fig. 10.—Corrected mandibular impression.

tuberosity, inclining inward from the border of the crest to a point which would be below the attachment of the buccal and labial peripheral muscle tissue. The purpose of this plane of relief in our individual impression tray is to insure the development of the valve producing area with a material that will not displace, encroach upon or hinder the free action of the peripheral muscles.

For the final step in the taking of the impression, we suggest "snow white plaster No. 2" because the accelerator is contained in proper proportions for a three-minute mix. A 2-ounce bottle, a Kerr cup[1] for measuring the plaster of Paris, an aluminum slab 5 by 5 inches, a medium sized plaster bowl and a bone cement spatula should be supplied.

Six level measures of "snow white plaster of Paris No. 2" are placed in the bowl and 2 ounces of cold tap water is added. This is covered with the aluminum slab and shaken vigorously for thirty seconds. The slab is removed and the bowl rotated until a glaze appears on the plaster. The glaze on the surface is an indication that the plaster is of the proper consistency for the impression. A uniform coating of plaster of Paris is deposited over the intaglio of the individual impression tray. This may best be accomplished by pouring the plaster into the individual impression tray and allowing it to spread until a layer from 3 to 5 mm. thick is deposited. The tray with the wash is carried to the mouth, and the patient is caused to lean well forward, allowing the excess plaster to escape. Then, the tray is thoroughly and firmly seated with a vibratory motion; the cheeks and the lips are gently massaged; the patient's head is guided back to the head rest, and the lip is raised to ascertain whether or not the periphery has been reproduced. If, for any reason, there is evidence that the plaster has not been carried to position and that the periphery is short at any point, a sufficient portion of the still workable plaster is added with the bone cement spatula, and the area where the additional plaster was placed is again massaged. In from two minutes and thirty-five seconds to three minutes, the plaster will have reached its initial set. At the end of two minutes, the patient should be given a glass of cold water and instructed to rinse the mouth carefully to remove any of the plaster wash that may be causing discomfort. Heat is a great accelerator in the setting of plaster of Paris. Plaster of Paris will crystallize more rapidly in warm than cold weather. A vigorous person will cause the plaster to set rapidly as compared to one of low vitality. Therefore, the exact time for the initial set cannot be positively stated. A little plaster placed on the tip of the operator's thumb at the time of the insertion of the impression is a good

1. One Kerr cup is equal in volume to one standard tablespoon.

indicator as to the action of the mix. When the plaster has set, the patient may be given a glass of water and instructed to go through the exercise of rinsing the mouth until the impression is loosened. If this is not possible, the operator should place the tip of the index finger along the buccal rim of the impression until the most distal portion is reached. The patient is instructed to close the mouth in order that the buccinator muscle may relax sufficiently to permit the peripheral valve seal to be broken. The operator should gently rotate the palm of the hand from within outward, and the impression can then be easily dislodged. In some instances, owing to an overdeveloped tuberosity on one side, the impression cannot be easily dislodged from that side. When such a condition exists, the operator should attempt the removal of the impression from the side presenting the more nearly normal condition. Having been removed from the mouth, the impression should be held under a cold water tap and rinsed thoroughly to wash away any traces of saliva and small particles of plaster. The impression should now be laid aside until the plaster has completely set. As soon as the impression is dry, a varnish should be applied to protect the plaster wash. (Fig. 7.)

Fundamentally, the technic for taking the mandibular impression is the same as the maxillary. First, a suitable metal tray is selected. It is not uncommon to find it necessary to trim the buccal and labial rims and the lingual flanges to preclude impingement on the muscles. Taking the impression of the stress bearing area is simple. On the other hand, the valve producing area requires the most exacting technic.

The impression tray compound is prepared for the mandibular impression tray as previously described for the maxillary impression. The material is shaped so that the greater mass is toward the lingual flanges with just enough to cover the buccal and labial rims. The surface is glazed, immersed in warm water to temper and adapted in the mouth. Care should be taken to center the tray directly over the ridges. At the first stages of developing the individual impression tray, the compound is never firmly seated immediately upon placing the tray in the mouth. The first step is to place the tray in position so that all areas to be included in the impression are uniformly covered. While the operator is still guiding the tray into position with the index fingers of both hands over the floor of the inverted tray, the patient is directed to raise the tongue to the border of the upper lip. The patient is instructed to relax and to close the mouth gently. Then the operator firmly seats the impression tray and holds it in position. The patient is then told to place the tongue against the roof of the mouth, with the tip of the tongue well forward, and swallow. This muscle action will tend to produce the peripheral roll on both buccal and lingual portions of the impression. The impression tray compound may now be chilled, removed from the mouth, dipped in ice water and wiped dry. At this point, notice is taken as to definite detail. (Fig. 8.) If sufficient detail over the stress bearing area is secured in the negative, any excess material should be cut away and the periphery carved in the shape of a thin roll. The impression tray compound is reheated over a low flame until the lingual surface of the impression is superheated.

It is tempered in warm water, inserted in the patient's mouth, and the exercise of "close and swallow" is repeated until a sufficient development of the lingual periphery is acquired. The operator may then remove the tray from the mouth, chill in ice water, wipe dry and, with a sharp knife, trim any overhanging material away from the borders that would interfere with separating the metal tray from the individual impression tray. The two trays are then separated and the individual impression tray is carefully trimmed, any excess material being removed from the lingual flanges, this producing a thin smooth impression tray. The extent of the posterior ridge portion should be carefully noted and reduced to a position that will just include the retro-molar area. The buccal and labial periphery of the individual impression tray is reduced until free movement of the lips will not dislodge the tray. (Fig. 15.) Conversely, it is observed whether or not the lips may be moved freely without interference from the individual impression tray. The inner borders of the distal portion of the lingual flanges are reduced with a sharp knife until the area over the mylohyoid ridge is free from contact with the individual impression tray. (Fig. 9.) The buccal and labial rims of the individual impression tray that are in contact with the valve producing area should be beveled from the highest point of attachment of the peripheral tissue to the rim of the individual tray. This treatment will insure a firm contact with the stress bearing area. The relieved lingual flanges and beveled buccal and labial rims provide for the development of the valve producing area of our corrected impression with plaster of Paris.

The technic for manipulating plaster of Paris is followed as previously described in taking the maxillary impression. The mandibular individual impression tray, coated with an excess of the plaster wash on the lingual portion, is inserted over the ridges; the patient is directed to protrude the tongue to the border of the upper lip, then to close to a relaxed position, and the tray with the wash is firmly carried to place. After three minutes, it is removed from the mouth, allowed to dry and varnished. (Fig. 10.)

A most satisfactory separating varnish may be made by dissolving 1 ounce of borax in a quart of boiling water, adding 2 ounces of flake shellac and coloring with indelible lead to suit.

As soon as the impression is dry, it should be coated thoroughly by dipping or painting with the varnish, and rinsed under the cold water tap at once. The cast may be poured immediately.

CONCLUSION

From a study of full denture problems, the following deductions have been made: Full denture patients with the most nearly normal tissues after wearing dentures for a number of years are those whose dentures have had just a comfortable adaptation and retention.

To maintain adaptation of the denture base, the impression must be taken with the purpose in mind that equalized bearing must be maintained under stress or tissue changes will occur. Atrophy of the alveolar tissue may result from either positive or negative force.

Individual impression trays are most practicable for securing impressions of edentulous cases. The impression of the valve producing area is the vulnerable

area from the standpoint of retention.

Carding wax has a flowing stage which is at body temperature, making it ideal as an agent to control tissue compression.

A definite volume of snow white plaster No. 2 combined with a definite volume of water, shaken for thirty seconds in an air tight receptacle, gives a mix that is always of the same consistency, working stage, setting stage, strength and hardness. The working stage is of much longer duration than in a spatulated mix. No heat is evolved in the plaster during the initial crystallization owing to the abundance of free water retained.

The hydraulic action of the plaster of Paris wash minimizes compression of the soft tissues.

The uniform distribution of plaster of Paris over the intaglio of an impression tray has a marked influence on the hydraulic action of the material.

The individual impression tray technic, in conjunction with carding wax and a plaster of Paris wash, minimizes the variables which would accrue were a quantity of the materials used.

This technic eliminates the personal equation as far as the patient is concerned; that is to say, the operation is solely in the hands of the operator.

The technic employed in impression taking has a marked effect on the health of the supporting structures. Denture service is a health service. The utility of full dentures depends largely on the health of the supporting structures. No one technic is infallible; modifications are always in order.

No originality is assumed for the technic herein described as the ideas have been assembled from the works of many men, to whom I acknowledge my debt.

DISCUSSION

John S. Kellogg, Chicago, Ill.: There are phases of the work that we have heard described which are most striking. An outstanding feature, and perhaps the most valuable of all is the fact that the whole procedure seems to have been developed to simplify and shorten a task which usually is disagreeable and difficult. We should recognize and appreciate such an effort. It is the best work a teacher can do. It insures its value to others. When one has worked out the detail of a mechanical procedure and perfected a process adequate for his own needs, he might naturally feel that his task is ended. This is quite true if he alone is to apply the result of his labor. But if his conclusions are to be given to and utilized by others, his work is only partly done. Working details, plainly simple for one operator, will often prove complicated and difficult for another even if the directions are most thoughtfully presented. Consequently, as the process is simplified, its application is facilitated. It becomes easier to give working directions with reasons which are obvious and logical, which may not be mistaken and which cannot be questioned. It takes careful consideration and good judgment to reduce such a process to the last word in simplicity with no sacrifice of principle or accuracy. This is what has been done; for the idea seems to have been the keynote of the whole operation. It is easy to understand, if we keep in mind that the originator is one engaged in teaching and of necessity must make every effort to present his ideas to men inexperienced and untrained. What he knew and what we now learn is that this simplicity is just as valuable to the trained practitioner as it is to the undergraduate. Those engaged in practice know that changes of detail naturally develop, no matter what technic we are following. This facilitates the work of an operator and, without departing from a principle, permits a change at certain points which, without complicaton, individualizes his efforts. The fact remains that principles can be best taught to either group, trained or untrained, when simply presented. The development of detail will come with application. Another point of value is the effort to eliminate assistance from the patient. We all know how difficult it is for a patient to follow directions during the process of impression taking. It not only

presents difficulties to the operator but also is just as unpleasant to the patient. If we ever succeed in developing a technic which requires no effort from the patient, we will have done much to lighten the task for all concerned. With this idea in mind and as a possible means of eliminating still another effort on the part of the patient, it seems in order to express a doubt on one point. This concerns the post-dam and the posterior termination of the upper impression. We are told that carding wax will mold to adaptation of the raised portion of the soft palate as the act of swallowing elevates the muscles; and that this procedure definitely marks the posterior extent to which the impression should be developed. Although it is not stated, the presumption is that the compound tray is trimmed to a length indicated by the post-dam. But there is no means of definitely determining the posterior extent of the increased compression from the post-dam. An impression carried to a length so indicated might be too long for comfort. There is also doubt that the material has time to change during a process so fleeting. But if this is true and the thickness of the post-dam is definitely determined, it still seems unlikely that the position of a line for posterior termination will be shown on the impression. Suppose the compound tray were trimmed to a definite posterior line before applying the post-dam material. This can be done by marking and testing with an indelible pencil. Such a line may be definitely placed at a point where muscular movement is slight and where there is no danger that the denture will extend far enough for discomfort. The carding wax might then be placed as described and held with the tissues compressed until enough time has elapsed for its adaptation. There need be no fear of overcompression for the excess may be trimmed away and the exact thickness of the post-dam inspected and controlled. This slight change would increase the operator's independence of the patient and remove the necessity of one more effort, usually difficult to perform. It would add a point to one of the prime principles of this procedure, the elimination of assistance. It should increase the accuracy of placing the posterior periphery and obviate any necessity of adjustments at this point, with their attending dangers. The intent of the suggestion is entirely constructive. The hope is that it may be valuable. There is a third point for which too much appreciation cannot be shown. The means of handling plaster of Paris for the final adaptation is a decided achievement. It gives us an accuracy of technic which is easy to follow. There is also a certainty of uniform results. The latter fact alone gives it outstanding value. This technic has been developed, using one particular trade article, but it seems logical that, with some effort and experimenting, the same method of proportioning and mixing might be adapted to any other product which an operator might prefer. It undoubtedly does remove some of our greatest former difficulties in the use of this material. While so little credit is claimed for originality, much should be given for such skilful compilation and wise adaptation. It has been a pleasure to listen to a description of a technical procedure which, maintaining the keynote of brevity and simplicity, has been evolved and made practicable by long effort and repeated trial until it has been proved by successful results.

DENTAL ECONOMICS*

By R. C. WILLETT, D. M. D., Peoria, Ill.

THE subject "Dental Economics" is one of wider range than is suggested by the title, or embraced by first thought, and to cover it fully in the time allowed is impossible. The fundamental weakness of our professional position as related to economics can only be touched on. The subject matter here presented is intended to apply to the rank and file of our profession, and not to the outstanding individuals whose talents and unusual abilities in some special line of it should have the universal support and protection of society for the things of value they have created for the benefit of all.

Under the heading "Dental Economics" are problems which have not been satisfactorily solved by dentists. The definition of economics as given in the Standard dictionary is: "The science pertaining to the production and distribution of wealth." The public will readily concede that the dentist has something to do with the distribution of wealth; perhaps it will less readily admit that he is only remotely connected with the production of it. In this respect, the dentist must be classed with the physician, teacher, musician and artist, who are not directly producers of wealth, but who are producers of things beyond price because of their value to humanity.

It is frequently, and unfortunately, a fact that the greater the cultural, moral or social value of a thing produced, the less is its monetary value in the eyes of its beneficiaries. For this reason, the dentist should carefully and logically consider every phase of his position in relation to economics, and if he still chooses to remain a dentist, accept the handicap, and find a way to master the dental economic problem, until he can develop some means of compensation with which to offset the fundamental weakness in the relation of his profession to economics.

As a group, we have permitted traditional dogmas to interfere with our economic advancement. Now, there is no reason for the perpetuation of any tradition in practice if such tradition is contrary to sound economics; but it is a fact that dentists, handicapped by a belief that their earnings must be limited to the result of their individual work in their chosen profession, have not permitted themselves to discard tradition by extending the field of their labors professionally, or by taking a direct and positive interest in some line of business which pays substantial dividends to those investors who possess sound judgment, or who have developed talent for organization or executive work. We are behind, and not a part of, the procession of physicians, lawyers, teachers, artists, musicians and engineers, who for years have been doing this without detriment

*Read before the Peoria County Dental Society, Nov. 7, 1927.

to their usefulness, success or prestige in their profession.

In our own city, and in most of other cities, we find successful physicians serving as directors in commercial enterprises. The names of eminent engineers appear on the boards of big industrial plants.

In the past, we have not thought of ministers as men of keen financial ability, but today many of them are adding to their vocational incomes by functioning in the capacity of life insurance executives. In fact, practically every professional group is well represented in these business positions, except that of the dentist. I cannot see why a physician should make a better bank director than would a dentist; nor is there any reason within my ken why a dentist should not have as good business judgment and as keen executive powers as a physician.

Yet the names of physicians—and I single them out only because they are more closely related to us than members of any other group—are plentiful on the published lists of the directors of commercial or public enterprises; while that of the dentist is infrequent—in fact, rarely appears.

Now, if dentists are to advance economically, while the rules of professional practice remain as they are, they must get into activities outside their own sphere.

Would this venturing of the dentist into commercial fields of action lessen his professional prestige? The experience of the physicians who have thus dared the bugaboo of unreasonable custom is the answer to the question; for the esteem of the public for a competent physician or surgeon is not lessened because he utilizes his common sense in business, or a fine executive ability in helping to direct dividend paying companies; and professional men who have achieved success have discovered that the result of their interesting themselves in a profitable sideline has been the acquirement of greater capacity in their own special line of work.

Now, aside from this gain, modern public opinion, and this opinion is important to us all, rightly or wrongly sets a higher appraisal on the professional man who is evidently making money than it does on the one who is just "getting by" financially. In stating this fact, I trust that no one will understand me as even suggesting that, for the sake of making more money, anybody should engage in activities that could interfere with the one big program of his professional life; for that would invite inevitable disaster.

A pertinent question arises as to what has held us back as a group from taking advantage of the commercial opportunities that undoubtedly have, from time to time, been open to most of us. How can we explain the fact that so few dentists' names are listed on bank boards of directors? What is the reason why they are so seldom called on to lead civic movements? At times, I have thought that, outside our profession, we are held in the bonds of a sort of inferiority complex.

Perhaps some one will say that dentists, as a rule, do not earn, and therefore cannot save, as much money as those in other professions, and consequently are not in a position to invest in the high priced shares or bonds of big industries, or to have the attention of the public called to their eligibility for election or appointment to positions of civic leadership; but from such statistical information as I have been able to gather in the short time afforded, the

average income of the dentist is greater than that of the physician.

Perhaps, after all, the main cause is a too close and crippling observance by us of old customs and outgrown traditions. If this is so, the remedy is with us, as individuals and as a group. We should at once begin to study carefully investments, price trends, industrials and especially their earnings, in order to safeguard our finances and find safe placement for our surplus money. Today, a farm mortgage is not the one and only security in which persons with a few hundred or a thousand dollars can invest; industrial paper has come to the front, but without painstaking and persistent study and investigation, an excursion into this field may prove disastrous.

In an article by H. L. Mencken recently published in the *Chicago Tribune,* Prof. Griffith Taylor, the noted Australian geographer and economist, was quoted as saying: "For a century more at least, the American people will be considerably richer than the people of any other land." And he cites as his reason for this prediction our great natural resources.

According to this scientist, America will not reach the limit of her vast supply of coal, waterpower and metals within another hundred years, and there is no apparent reason why her temperature and rainfall (listed as peculiar advantages) should change for the worse. Mencken's own comment is: "America's continued leadership in assets, business and wealth should give the Americans a great cultural advantage, with more leisure, so they should be able to devote more time, money and energy to the building up of civilization."

My one purpose in quoting from these two writers is to stress the point that, with such a prospect that prosperity and wealth is to become more general in this country, it is a clear matter of just prerogative that dentists, and others in professional life, appropriate more of that prosperity and wealth for their own, if they are to catch up with and march in the procession, and I here make the statement without reservation that, in my opinion, we owe to ourselves financial success, even if we have to step into investments outside our profession to attain it.

The truth is that members of our profession, though entitled as fully to financial independence and an assured competency as those engaged in other professions, and purely commercial lines, are not, as a rule, possessed of that comforting and stimulating asset, a generous bank balance.

The years that are to bring increased wealth to America will pass rapidly, and now is the time for us to do some mental auditing to discover why we are not attaining to the financial standing that we have every right to expect.

Reverting to the main theme, which is the fundamental weakness of professional vocations, with emphasis, of course, on dentistry, let me present the hypothetical case of two young men, with the stage set for the entrance of one into the practice of dentistry, and the other into a mercantile business.

First, I shall briefly outline and compare the modest start of each. Assuming that the original investment of dollars and cents is the same, we shall see how widely the economic opportunities of the two young men will differ.

The dentist, we will say, is a high school graduate, with an additional course of two years at a university. We will take no account of the cost of this preliminary preparation, for it would be

the minimum one for a start in any vocation, whether commercial or professional. The cost of four years of professional training we will place at $8,000, and the equipment for a modest office in which to begin practice, at $2,000.

Our prospective business man is also a high school graduate, with a two years course at a university. In place of the other man's four years of professional training, he gets his intensive preparation during the same period of time, while employed in a well organized commercial establishment, and he finally selects for himself the business of selling office supplies and equipment, a business that can be operated on a large or a small capital.

Instead of investing $10,000 in specialized education and office equipment, he invests $10,000 in store fittings, and the stock of goods which he proposes to sell.

The two young men are now launched on their different pursuits on a fairly equal basis as far as monetary values are concerned. The first year is for both of them a struggle to maintain themselves and to make ends meet. Public patronage is essential for their success, and they go about its acquisition, holding strictly to the established code of business ethics and gentlemanly conduct.

At the end of the year, what amount of financial progress may we expect to find in the case of each? A careful inventory of tangible assets would probably record little or no gain for either man. Their greatest assets might prove to be an extended public acquaintance, and an established location and organization.

Time passes and, from outward appearances, perhaps of the two the dentist is prospering more. Possibly, he is a member of a prominent town or country club, and in the eyes of the world is "making good." The young business man seems to be merely "holding his own," but if our interest invites his confidence, he tells us that he is putting in a new stock department in order to serve a larger field of patronage and is paying an additional and competent clerk to manage it.

And here the difference between economics as applied to professional vocations and economics as related to commercial enterprises defines itself; for beyond certain limits in his professional contacts, the professional man is circumscribed in his opportunities for investments in growing business concerns that hold assurance of large monetary gains.

On the contrary, the young business man, in our hypothetical case, finds a plentitude of ways in which to make every dollar work for him, and he has no leisure in which to read the dozens of wildcat propositions, the alluring assurances of a quick fortune, to be acquired through the infinite capacity of the muskrat for parenthood, or the hundreds of "sure tips" that come to his desk.

If he is to succeed, the very nature of his business demands every hour of his day, every dollar of his capital, all of his credit and, above all, the maintaining of that credit.

The dentist, limited in chances for profitable investments through his practice, must look elsewhere for the solution to his problem in economics if he is to accumulate wealth. Not being safeguarded by the business man's four years of practical experience, or the "eye-opening" nature of industrial pursuits, the dentist has unconsciously developed "negatives" much to his disadvantage in economic practice. Many of those "nega-

tives" could be cited, but I name only one: a shortsightedness of view in regard to plausibly presented schemes for making money, and the taking for granted of sound fundamentals of safety in the investment of cash in enterprises luringly described by promoters or presented in expensive circulars.

Many persons think that the two havens of safety for the professional man are life insurance policies and building and loan stock. These are good as far as they go, and they might absorb all the excess earnings of all the professional men in all of the professions and not in the least embarrass the promotion of other legitimate business; but this would not be a good business policy to follow.

Rather should we seek to diversify sound investments, for the reason that such diversification is a matter of business principle, and because of the broadening influence that it will have on our lives, which depend for continuity on a world of facts.

Surely if, professionally, we are allowed but one string to our bow, we ought not to be limited in the number of arrows allotted us for target practice at financial success.

I trust that I have said something in this brief talk that will cause dentists to do some serious thinking—and acting—in regard to a remedy for a situation brought about by the very nature of our profession. I will admit that any dentist, by attending strictly to his own calling, can make a good living, besides occasionally putting a little surplus into a share of building and loan stock, an extra insurance policy or a standard bond; but it grows clear to me that, as with business men and the men of other professions, the achievement on our part of a greater financial success is a worthy ambition, and one which we can reconcile perfectly with what we insist is our high calling, and that, for such purpose, we are free to adapt ourselves to any phase of economics that is in accord with the ethics of good business, and, by so doing, claim as our right our share of this world's riches.

Let us by all means continue to practice our profession with all the skill and learning that we are able to master, but, in the meanwhile, let us not lie back supinely watching the achievements of others in the accumulation of money, even though the others are more highly favored by the rules of the commercial concerns of today, and their interpretation of such rules.

I have dwelt on the accumulation of things of monetary value, but, before closing, I am impelled to speak briefly of another kind of wealth, the acquirement of which by any one counts for more than the tangible assets of the entire world. Because the urge to possess this "other kind of wealth" was seeded in the first man, from the code of Manu, the oldest book of the ancient Hindu law, compiled in 1280 B. C., I quote this passage:

"The man who keeps his senses in control, his speech, heart, actions pure and ever guarded, gains all the fruits of holy study; he needs neither penance nor austerity . . . . Depend not on another; rather lean upon thyself; trust to thine own exertions. Subjection to another's will gives pain. True happiness consists in self reliance."

If we fulfil within ourselves the conditions of character attainment as set forth in this quotation, and pass on to our children the teaching and the practice of such a law, we shall leave to them and to the world at large great riches that cannot be appraised by any standard of monetary values.

DISCUSSION

C. Carroll Smith, Peoria, Ill.: Dr. Willett has given us considerable to think about. If I had been advised along the lines of which he has spoken when I started my career as a dentist thirty-seven years ago, I should be in a better economic situation than I am today. To make money is one thing; to direct and manage it properly and with frugality is quite another. Dr. Willett gives us the keynote to the whole situation when he brings to our attention the fact that it is not the money that we dentists make but the way that we invest it that counts. It is not the show that we put up before the world that brings us independence in later years, but the foundation that we lay in substantial securities. Dr. Willett has given us timely suggestions as to the laying of such a foundation, and he has given it in a way to bring hope to even the smallest professional earner. The dentist's income is not commensurate with the community's estimate of his earning ability. It takes courage and self-reliance to resist the community's expectation of his expenditures and be judge and conservator of his own resources. In this day of club membership and all that goes with it, the best club that a man can belong to is an investment club. The specific savings department of the modern banking establishment has given many a man a start toward financial independence. By joining this club, a dentist may take his first steps on the road to thrift. After the first $500 is saved, there is an opportunity to begin a diversion that will be a benefit to the earnest and honest student of economics. Wise study of investment securities will furnish an interesting sideline of endeavor that will safeguard a man against the wasting of his funds, give him an atmosphere of respectability, furnish him with fascinating employment that will add to his resources and productivity, increase his confidence in himself and his fellow man and provide him with a competency that will remove the embarrassment of dependency in his last years. Some time ago there appeared in *The Gideon* a short estimate of economics entitled, "What Class Are You In?" I quote from it the following:

Of every 100 in America:
Eighty-five die penniless.
Fifteen leave under $10,000.
Three leave over $10,000.

Of 100 average men in the United States:
Forty-six at 45 have saved nothing.
Thirty at 45 need aid.
Fifty-four of the 65 alive at 65 are objects of charity.

Of every 100 widows:
Forty-seven have to work.
Thirty-five are supported by charity.
Eighteen are left well off.

Certainly these figures should awaken us as dentists to a sense of positive interest in some line of economic endeavor that will enable us to use our earnings more advantageously than spending our all to keep up appearances and move with the throng. If we are to make any economic advancement, we must, as Dr. Willett has suggested, break away from traditional dogmas that have hampered us; the negatives that we have developed in our narrow professional careers; the inferiority complex that we have acquired by our short-sightedness and failure to take advantage of the economic opportunities about us, and our false restraint in not connecting ourselves with legitimate business enterprises. Self-reliance is a wonderful characteristic. It is more often acquired than inherited. It comes by experience in the school of hard knocks. It takes a lot of hard knocks to drive home economic sense to some of us dentists. I believe self-reliance comes to the man who is a producer. This production must have its inception in a dentist's conscientious devotion to his chosen profession, not for the mere matter of making money and a living, but for the purpose of practicing his profession to serve his fellow man and be a credit to the productive activity of the community in which he lives. With such a laudable ambition impelling one to action, an honest return in monetary values is sure to accrue, and, little by little, the savings from such an income invested in economic situations, backed by good business policy, will put a man in the independent class, characterizing him as a "producer and distributor of wealth." First of all, we are dentists, to give conscientiously to the public the help they need through the service we are capable of rendering. Secondly, we are entitled to financial success. Lastly, will we develop business sense enough to study our problem and rise to the economic demand by working out a business modulus that will be a compliment to our profession and a fitting reward for our endeavor?

HABIT AS A CAUSATIVE FACTOR IN MALOCCLUSION*

By WILLIAM E. FLESHER, D.D.S., Oklahoma City, Okla.

HABIT is the tendency to repetition. The more frequent the repetition, the more fixed the habit.

The extent of this subject is as broad as the universe. It affects inorganic as well as organic matter. Our hats and our shoes fit better after they have been worn a few times. They take on a shape peculiar to their new situation, which is peculiar to the person wearing them. The adaptation is individual. A drawer in a desk will slide with greater ease after being used for some time. An automobile will run more smoothly after a little use. A sheet of paper folds more easily the second time.

The performance of an act for the first time requires a certain amount of thought, a conscious effort, as well as careful control of the neuromuscular function adapted to this particular movement. When performed the second time, it requires less of our attention, and so on, until, eventually, it becomes automatic, requiring little or no conscious effort. It is then a fully developed habit. Through repetition of a series of acts, one can become accustomed to their performance with practically no thought, such as dressing and making one's toilet in the morning, or the other usual tasks in a daily routine. To start at the beginning of this chain of actions is about all that is necessary to complete its performance. One will go from one act to another in the chain, scarcely giving a thought to what is being done.

We can see how much freedom such habits give to the conscious mind, how they save our time and prevent fatigue, releasing our higher thought centers to take care of such situations as may arise.

We little realize just how important is the phenomenon of habit. If the repetition of an act did not require less of our conscious effort at each performance, until it becomes automatic, we can see how impossible life would be. There would be no enjoyment in living. We should be so completely occupied in the performance of every simple act that we could accomplish nothing. We could not carry on a conversation, as all our thoughts would be centered on our efforts to pronounce the words. Sitting or even the movement of a hand or foot would consume all our thoughts. This, in a measure, causes us to understand what an aid to development and growth is the control of so many functions by the unconscious mind.

Only through habit can such acts as driving a car be accomplished. We handle the clutch with one foot, the gas control and the brake with the other foot. The right hand manipulates the shifting lever and emergency brake, the left hand takes care of the steering wheel, directing the car this way and

*Read before the Section on Orthodontia and Periodontia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

that as indicated by the impressions one receives from the vision ahead. A musician becomes so skilfully trained that the fingers move to and fro over the keyboard, each of his fingers seeking the particular notes indicated for it; and while he is playing, he can even carry on a conversation, the playing has become so automatic. All this comes through practice, repetition.

We do not have to think of just how we grasp a spoon or how it should be carried to the mouth as does a child. These habits have grown into us. They are a part of our personality.

Thus, we are reminded how habit saves our time, simplifies our movements, produces less fatigue and develops our skill by making our movements more accurate. It diminishes the conscious efforts with which our acts are performed. It prepares and keeps us at our tasks. As James[1] says, "Habit is second Nature."

Johnson[2] discusses habit as follows:

> In the organic world, the Law of Habit forms a part of the ground work of life. Every form of activity shows signs of its influence; the moral laws, the intellectual acquisitions, the physical activities of both the individual and the race. This tendency to the repetition of action is agreed to be the corner stone of the various theories of development, since with contractility, it is fundamental in organic adaptation. It reduces action to the realm of the subconscious, and makes possible the highly complex adjustments and activities of every day life. If it were necessary to consciously guide and control every movement and action of our waking hours, we should have time for little else. Thus it is from the fact that an action once performed is more easily done each time it is repeated that our personalities develop. Habit is a name given to this intrinsic property of matter to repeat what has already happened. It is because of the uniformity of the appearance of this phenomenon in Nature that it is recognized as a natural law.

Dearborn[3] reminds us that habit is a universal process of matter, either organic or inorganic; that its basis in the organisms is in the matter and not in the mind; that a mental habit means practically nothing; that it is unbelievable that habit in an organism is a mental process. He states positively, "It is matter, protoplasm, that has habit."

All writers agree that habit is a natural phenomenon of living protoplasm. The degree to which protoplasm is influenced by these impressions—habits—is due to its plasticity. James says:

> Plasticity means the possession of a structure weak enough to yield to an influence, but strong enough not to yield all at once. Each relatively stable phase of equilibrium in such structure is marked by what we call a set of habits. Organic matter, especially nervous tissue, seems endowed with a very extraordinary degree of plasticity of this sort; so that we may without hesitation lay down as our first proposition the following: that the phenomena of habit in living beings are due to the plasticity of the organic material of which their bodies are composed.

Johnson further states:

> The phenomenon of habit is a normal manifestation of living tissue essential to the development and functional activities of the organism. Normal habit movements help to maintain normal structural form. Abnormal habit movements are associated with abnormal structural form. Habit, then, an intrinsic organic force, like all natural processes, is a factor in adaptation which if perverted in its action will be as potent an influence in maladjustment and subsequent disorganization. A pernicious habit is an expression of a natural phenomenon gone wrong.

1. James, William: Habit, New York: Henry Holt & Co., 1918.

2. Johnson, A. L.: Habits, Internat. J. Orthodon, 1: 71 (Feb.) 1915; Basic Principles of Orthodontia, Dent. Cosmos, 65: 379, 503, 596, 719, 845, 957 (April-Sept.), 1923.

3. Dearborn, G. V. N.: Habit and Malocclusion, Med. Rec., (Oct.) 1915.

When a pernicious habit takes control, it is a pathway of discharge wherein some pleasure or satisfaction has not been gratified.

Dearborn says:

> The basis of the fact that it is easy to form habits, especially bad habits, in the long run is always satisfaction in some way or another. We always get satisfaction, of course, out of the repetition of an act which gives any degree of pleasure. . . . Often the satisfaction derived from a habit is subtle and hard to appreciate, and yet it is none the less effective. In other words, it may be purely physiologic, kinesthetic or tactile. A neuromuscular habit may be purely kinesthetic, or it may be a matter of satisfaction derived from the pure sensory experience of touching things, perhaps the result of an instinct of an exploratory nature. The dynamic basis of the satisfaction, as of joy, is the kinesthetic or normal bodily activity becoming more and more inhibitory as the child's personality unrolls. A child may do things which promptly lead to fixed habits with any one of these three physiologic suggestions, so to speak, behind the movements. Action itself is seen to be satisfaction in this way, and muscle action, at first made by chance (being really developmental practice), may become quickly and fixedly habitual by repetition long before any habit is realized.

In associating habits with malocclusion, we usually think of bad, or abnormal, habits. In the broad sense, normal habits and their associated normal functions are the basis of our development and growth. Abnormal habits and abnormal function, which always go hand in hand, have a deterrent effect on growth and development. With the influence of normal habits and normal function, and the resulting development of the dental apparatus and the associated structures, we have every reason to expect a typical occlusion of the teeth. But when the forces, whether constant or intermittent, which are associated with pernicious habits are at work, we may expect maldevelopment and its resultant, inharmonious relation of the dental structures.

Pullen[4] makes this observation:

> Many of the simple cases of malocclusion as well as those of a complex character are directly, or indirectly, traceable to abnormal habits of a neuromuscular nature. Inasmuch as these habits are intimately concerned with the muscles of the face and the oral cavity, the lips, cheeks, and tongue, the abnormal forces which are called into continuous or frequent intermittent action have the effect of not only changing the normal form of the dental arch to the abnormal one, normal positions of the individual teeth to malposition, but of causing malocclusions and facial deformities which are characteristic of the particular neuromuscular habit involved. In the respiratory habits the posture of the chest and shoulders may be abnormal and, in the extreme, we have the typical adenoid thorax.
>
> Thus, it is obvious that the abnormal muscular forces exerted in habit cases are continuous as long as the abnormal habit is continued, and if the latter is not checked in its incipiency, the resulting malocclusion and facial deformity become more and more abnormal as the habit is persisted in, and is related in degree to the force exerted by the abnormal muscular action and the length of time the habit has been continued.

We will now consider some of the habits which are factors in producing malocclusion. As one of the first instinctive acts of mammals is that of sucking, we would naturally look on the sucking habit as of the pernicious type, the first to have a deleterious effect on occlusion. In the infant, there is a sensation somewhere that is demanding attention. Sucking being one of the first acts of the baby, he proceeds with the exercise of this act in an effort to satisfy this innate craving. He gets at least some satisfaction the first time, after which his thumb or finger wanders again to his mouth the second time. Then repetition of the act

4. Pullen, H. A.: Abnormal Habits in Their Relation to Malocclusion, Proc. First Internat. Orthodon. Cong.

follows and soon he becomes unconscious of it.

When nursing is normal (at the breast), it is a normal developmental force. As the infant tugs away at the breast, it appears to be the very personification of function. But when this act is perverted, as when sucking the thumb, fingers, lip, tongue or pacifier—and we may include the bottle—the normal forces of development are broken up through the displacement of the associated neuromuscular function.

Fig. 1.—Thumb sucking.

In the pernicious habit, the sucking force (Fig. 1) is a different act from that of the normal nursing process. The pulling stress or the weight of the hand and arm when the fingers or thumb are used aids the forward development of the lips and the upper teeth and alveolar process. The weight resting on the mandibular incisors and symphysis is a force affecting the development of this region, usually causing a distoclusion or a lingual displacement of the mandibular incisors in neutroclusion cases. There also may be a lingual relation of the incisors in the distoclusion cases. The maxillary incisors usually protrude and, in some cases, are spaced, showing an overdevelopment of the alveolar process in the premaxillary region. There is, also, frequently a constriction of the dental arch, especially in the bicuspid and cuspid regions. (Fig. 2.)

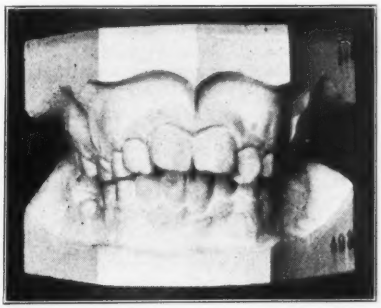


Fig. 2.—Cast showing constriction of the dental arch, especially in the bicuspid and cuspid regions, which results from thumb sucking.

Sucking of the lip and the tongue does not produce the severe malposition and facial deformities as does the thumb- and finger-sucking habit. This does not imply that these cases respond more readily to therapeutic measures. Figure 3 illustrates the effect of tongue-sucking. In this case, it produced a labioversion of the maxillary incisors and a linguoversion and bunching of the mandibular incisors.

I regard the use of the bottle in feeding infants as unfortunate. Unless carefully guarded, it can be the source of a habit that may continue throughout life and materially affect development and health. We have observed the use

of the rubber nipple on the bottle and know how it becomes softened; the more it is used, the larger the opening. The baby becomes habituated to this large nipple with its easy flow of milk. When a new nipple is placed on the bottle, he refuses it until, forced by hunger, he finally surrenders to the extra effort he must put forth to satisfy his hunger. Here the parent may weaken and produce the old nipple, through which the nourishment will flow with little effort. There is grave danger, in these cases, of developing a habit of ease in feeding, so

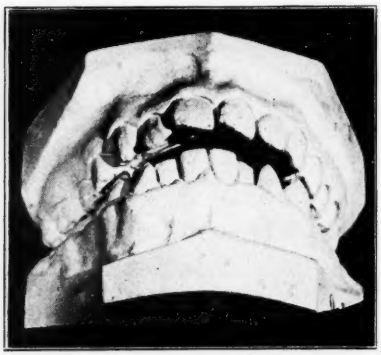


Fig. 3.—Cast showing effect of tongue sucking.

to speak, on the part of the infant. In other words, his tissues are trained for light use and he will not put forth more effort than necessary, refusing the bottle if it will gain the desired end—the satisfaction of his habit of ease. This lack of exercise and the arrest of development which naturally follows cause a weakness in all the structures of the masticatory apparatus and its functions. This would mean that, as the child develops and grows, there would probably not be the stress used in masticating his foods as if he were trained through a normal nursing process. In fact, he would probably develop an antipathy to vigorous use of the muscles and jaws in the masticatory function. This restricted use of the dental apparatus and associated structures would, in my opinion, have an inhibitory effect on the development of the dental apparatus, proving to be a factor in malocclusion.

Our instinctive habits must be encouraged at the proper time. In developing correct function in mastication, Johnson says:

> The eruption of the deciduous teeth marks the time to begin taking foods that require chewing. Consequently, that is the time to establish the habit of mastication, and unless it is done at this time, the chance of ever developing it sufficiently to establish and maintain the normal structural form of the dental apparatus is very doubtful. Moreover, in the same way as it is necessary to stimulate the function of mastication at just the right period of development by giving the proper foods, it is quite as important that nothing should interfere with normal function; and here we find rational principle for the care of the deciduous teeth. If, on account of pain somewhere in the dental arch as a result of caries, *or perhaps an orthodontic appliance improperly adjusted,* the chewing of food is a painful process, the habit of mastication will not develop in a normal way, and so normal structural development cannot be expected.

Mouth breathing has a decided influence on all the structures in the region of the nose and mouth. In fact, so pronounced is this condition that the resulting facial deformity is easily recognized. The instant the lips are parted, in mouth breathing, a change takes place in all the forces associated with the neuromuscular functions of the face.

Under normal respiration, with the lips closed, a vacuum is present in the oral cavity and the air pressure aids in holding the tongue and musculature of the floor of the mouth well up between both dental arches.

The air pressure in the nasal cavity aids in widening the dental arches as the case develops and grows. Thus, all the forces are balanced and, everything else being equal, we should have a normal development of the dental arches. But, with the vacuum destroyed by the opening of the lips, the air pressure in the oral cavity and nares is equalized and the upper lip is more or less retracted, and thus the balanced forces over the anterior teeth are destroyed. These factors, combined with the weight of the cheeks on the lateral sides of the plastic dental arches of the infant, result in a constriction of the dental arches and a protrusion of the maxillary incisors. (Fig. 4.)

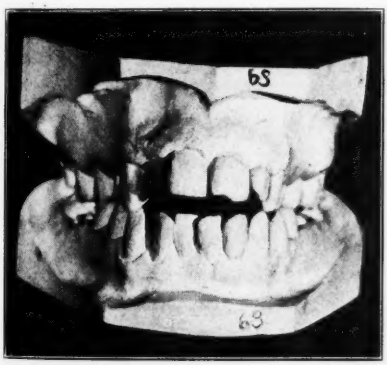


Fig. 4.—Cast showing effect of mouth breathing.

Another complication usually associated with mouth breathing and the presence of narrow dental arches is constricted and, usually, obstructed nasal passages. Some authorities attribute obstruction in the nasal passages to mouth breathing, while others favor the idea that mouth breathing is caused by nasal obstruction. Possibly both are correct.

With mouth breathing present (Fig. 5), the whole organism is, in a degree, functioning abnormally, which is another detrimental factor in the general development of the child, and, indirectly, affects the development of all dental structure.

Fig. 5.—Effect of mouth breathing on facial structure.

Biting the lips, tongue, cheeks and any other object held between the teeth as a habit is the cause of certain malpositions of the teeth. Children often, at play or in performing a tedious task, bite the lower lip or tongue. This is sometimes persisted in, and the tongue and lip are even held between the teeth during sleep. It is frequently observed

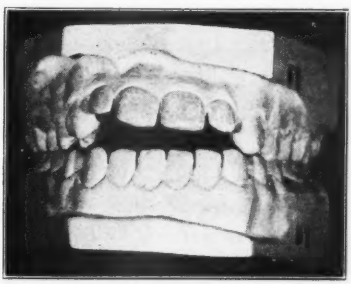


Fig. 6.—Cast showing open bite, the effect of various lip, tongue and cheek-biting habits.

that children hold their tongues in the opening created by the loss of the deciduous incisors and, this, if persisted in, will arrest the development in this region, producing an open bite. (Fig. 6.)

It has been observed in our office that, when there was a slight infraclusion of the incisors, on several occasions the children had a habit of thrusting the tongue between the anterior teeth as the act of swallowing was concluded. We know that the act of swallowing is frequent in some cases, and I believe that the action of the tongue in these cases has had a deleterious effect on the development, preventing the overlapping of the incisors. We have seen adult cases in which the stem of a pipe or cigars have caused displacement of the teeth. One case in my former general practice demonstrated the effect of holding a chew of tobacco between the bicuspids and molars. These teeth lacked about three-eighths inch of meeting in occlusion.

The effect produced by biting the lips and tongue is a labial movement of the maxillary incisors, sometimes a lingual displacement, and, in some cases, a depression of the mandibular incisors.

Posture and pillow habits have been given more consideration as causative factors in malocclusion since Dr. Stallard's[5] discussion of these subjects. He presented an extensive treatise on the subject and apparently observed many cases involving sleeping postures.

It is a rather generally accepted fact that the assuming of one position for too long a period will act as a force in influencing the direction of growth and development.

It is pointed out that infants sleep practically all the time and if they are allowed to lie in one position the weight of the head will mold the plastic tissues abnormally. The patient shown in Figure 7 reported that she slept on the right side of her face. Figure 8 shows the cuspid, deciduous molars and first permanent molar in linguoversion.

Fig. 7.—Effect on shape of face of patient's sleeping on right side.

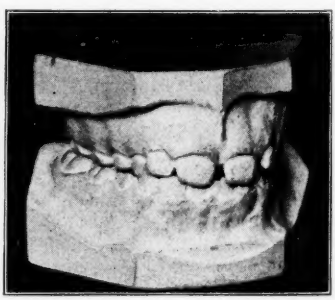


Fig. 8.—Cast showing cuspid, deciduous molars and first permanent molar in linguoversion.

The use of pillows in sleeping is regarded as having an influence in producing deformities.

Stallard also calls attention to the greater prevalence of malocclusion among malnourished children, especially

5. Stallard, Harvey: Etiology of Cross-Bites and Gothic Arches, Dent. Cosmos, 65: 1181 (Nov.) 1923.

those having rickets. This is accounted for by the lack of calcium in the osseous structure.

In the study and diagnosis of our cases, we are confronted with the complexity of the human organism. From the beginning of the development of any organism, or even before the union of the primary cells, various influences are directly or indirectly affecting the direction of its growth and development. We are seldom, if ever, justified in registering a single factor as the cause of a malocclusion.

Speaking of the adaptation of the tissues to function, James says, "Deep down in the nerve cells and fibres the molecules are counting, registering and storing up the resultant of every action, be it for good or bad."

Sherrington[6] reminds us that "all parts of the nervous system are connected, and no part of it is ever capable of reaction without affecting, or being affected by, various other parts, and it is a system certainly without rest."

To aid in arriving at a diagnosis, various factors should be considered, beginning with the health and age of the parents; the health and environment, including the diet of the mother during pregnancy; the functional response of the digestive tract of the infant immediately after birth when it is being used for the first time, diet and nutrition, assimulation, diseases, the amount of exposure to sunshine, etc., and the function and adaptation of these forces.

But, in our study of these factors, we must not overlook the powerful influence of habit on our system. Through its effect on growth and development, it is a definite force, and, if abnormal in its functions, it is a factor in the causation of malocclusion.

806 Medical Arts Building.

6. Sherrington, C. S.: The Integrative Action of the Nervous System, Yale University Press, 1906.

DISCUSSION

Ernest N. Bach, Toledo, Ohio: Apparently, there are as many definitions of habit as there are psychologists, yet all definitions are based on a common ground, protoplasm. One by Dr. Angell contains the gist of the various ones quoted by Dr. Flesher: "A habit is the lessening of the resistance between the dendrites in a synapse." If we can picture a sensory fiber going to a switching station (synapse) and terminating there in fine threads, (dendrites) and closely mingling with but not in contact with other fine threads (dentrites) which are attached to the end of a motor fiber leaving this station, we have a good idea of where habits are formed microscopically. It may be interesting here to trace an impulse which is eventually to become a habit. A child taking its first piano lesson has no correlation of the hand and eye, of seeing a note and striking the proper key. A note is indicated on the composition or chart. The sensory impulse is carried to the synapse located in a ganglion, terminating in the sensory dendrites. Here, it makes its way through the resisting medium to the motor dendrites and finally through the motor fibers to the muscles of the hand and fingers. If this process of looking at the note, then locating it on the key board is repeated a sufficient number of times, the resisting material in the synapse is gradually weakened until no effort is necessary for an impulse to pass through it, and that habit is established. This or a similar explanation is necessary if we are to understand clearly the process in the formation of habits, in order that we may cope with the parent in the correction of the conditions or in the development of a desirable condition. I am intensely interested in the workings of an apparatus, an instrument, an automobile, machine or whatnot with which I have a continued contact. Merely turning the dials on a radio does not sufficiently satisfy one. A deeper interest lies in the knowledge of what is going on inside and why the tubes and condensers and coils are there. If one has an understanding of the working mechanism clearly in mind, it naturally follows that repair, correction or manipulation is more easily

coped with. So if we are to make any muscle correction or stimulation intelligently, we must know the origin, action and insertion of the muscles under consideration. So with habits. We should know what is going on within the habit forming mechanism and be sure of our ground in treatment. It will prove interesting and be of great value to read chapters from various psychologies on habits, their causes, values, correction, etc. All of us have met this inquiry at various times: "At what age do you advise orthodontic treatment"? My answer would be: "As soon as anything of an abnormal nature manifests itself." (This does not necessarily mean mechanical interference.) At this time, we have the advantage of checking up on detrimental habits and substituting desired ones, and thus taking advantage of age. Distoclusion cases, constriction of the arches, protrusion of the maxillary anterior teeth are without question a result of an abnormal condition which existed in the very early years, and the discovery of these conditions in their incipiency is of extreme importance. Faulty habits are not easily overcome. Dr. Angell writes: "To break up a bad habit means not only to secure a penitent, reformatory attitude of mind. This is often easy to achieve. It means a complete change in certain parts of the nervous system; and this is frequently a thing of utmost difficulty to attain." And again he states: "If habits be pernicious and of long standing, the slavery of the victim is sure to be pitiable and likely to be permanent." Too often habits such as thumb and finger sucking are forced on the infant by the unenlightened parent and nurse in charge. Such habits should be rectified on detection. The nearer the time of formation of a habit, the easier the correction. It is natural for a child, during its waking hours, to wave and swing its hands about the face, and also to place the finger or thumb in the mouth to satisfy the sucking reflex. Here the first breaking down of resistance occurs and the habit is instigated. As Farnsworth states: "No habits are ever formed except by action." Peters writes: "Good habits do not form themselves. Habit formation depends on repetition and focusing of attention upon the end to be attained while the repetition is going on." A person learning to play golf must concentrate on his stance, back swing, follow through, etc., at the time that he is trying to hit the ball. So, likewise, a child, when performing muscular exercises, should be taught why he is doing them and should constantly keep that reason in mind during the performance of that action. The comparison between nursing and bottle-feeding is little thought of except by the orthodontist and those more than superficially interested in development. Sylvan Dreyfus, of Lausanne, Switzerland, who has been carrying on experiments in the children's clinic in that city, writes: "We would like to remind you that the following factors act on the mouth and maxillae: 1. Muscular action, tongue, cheek and lips. 2. Atmospheric pressure, cheeks, lips and floor of nasal fossa. The nipple being short, the suction on the mother's breast brings the lips up close to the gingival arch and also widens the gingival arch in front. As a result of this action, the vacuum produced in the mouth draws the palate and flattens it; consequently, the floor of the nose drops and the fossae are enlarged. This action on the roof of the mouth is partly due, according to our observations, to the vacuum produced in the mouth while the infant is actually sucking, but is also caused by atmospheric pressure acting on the floor of the nasal fossa. Sucking at the mother's breast not only requires strength to draw up the milk but, owing to the shape of the nipple, which is very short, it also calls for a powerful action of the lips, which have to be firmly pressed against it so as to exclude the air. The muscles of the lips and particularly of the orbicularis oris have to do the kind of exercise which will strengthen them and will enable them later on to fight against the teeth projecting. The action of the lips is strengthened in proportion to the smallness of the nipple. It is evident that if the nipple were large, the lips would not have to make such an effort. It is easy to make such an experiment merely by sucking our little finger, then our thumb. As we saw in the second experiment which we put forward, when one of the fingers was sucked, this foreign body takes up the space between the tongue and palate and pushes the latter up, and this act is aggravated because the child sucks entirely with its tongue, the whole action resulting in a decrease in size of the nasal fossa, and very often producing a deflected nasal septum. In normal breast feeding, there is a suction on the hard palate, producing a more or less stretching effect on the septum, with a flattening of the palate bone. Artificial sucking tends to point-

ing of the palate and projecting of the incisors, and causes, to a certain extent, atrophy of the nasal fossa, and by this fact encourages the development of adenoids in children predisposed to them, while breast feeding tends toward the other direction." I am inclined to believe that Dr. Dreyfus means that these abnormal conditions are brought about in bottle nursing when the long large rubber nipple with large openings in it is used, as he has produced a nipple which more nearly resembles the human organ. It is a sad experience for a child when it must use one of these large nipples which the druggist deals out to the uninstructed parent with the remark that "this is the one which all the babies like." I am of the opinion that mouth breathing often begins in the early months of infancy, producing the usual constriction of both arches, and atrophy of the platysma, pterygoid and hyoid groups of muscles and shortness of the lips. If this condition is allowed to continue until the child reaches the age when he is conscious of the adenoidal appearance, he may close the lips and breathe through the nose, but will encounter great difficulty. I believe mouth breathing in the adult is more than a habit. It is a forced condition due to the shape and relation of the structures in the oral and nasal cavities, which, in turn, are the result of abnormal habits originating in infancy. Another factor which should be classified under habits is posture and correct breathing. It is mentioned here only for emphasis. Alfred P. Rogers, the pioneer in this work, has written a number of excellent papers on the subject, which have been published in the orthodontic journals from time to time.

DENTAL RESEARCH AT THE NATIONAL BUREAU OF STANDARDS

By GEORGE K. BURGESS,* Washington, D. C.

THE Bureau of Standards entered the dental research field in 1918 when a number of tests on dental amalgams were conducted at the request of the War Department. At that time, on account of the lack of sufficient funds, the Bureau was not in a position to continue or extend the research to the other materials used in dental prosthesis, although the necessity for such work was clearly indicated.

January 16, 1922, we entered into a cooperative research on these materials with the Weinstein Research Laboratories of New York City. This research has been carried on in accordance with the plan[1] authorized by Congress, April 12, 1892, and March 3, 1901. The specific problems included in this cooperative program were announced to the profession in 1924.[2]

Numerous progress reports[3] on the individual items of this program have been issued as the data were secured. From these, it will be seen that the ob-

*Director, Bureau of Standards.

1. Circular of the Bureau of Standards No. 296, Research Associates at the Bureau of Standards. (Available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents a copy.)

2. J.A.D.A., 11: 249-250 (March) 1924.

3. Souder, Wilmer: Physical Properties of Dental Materials, J.A.D.A., 12: 509-519 (May) 1925. Coleman, R. L.: Physical Properties of Dental Materials. II. (Wrought Gold Alloys), ibid., pp. 520-546; Physical Properties of Dental Materials. III. (Casting Process), Dent. Cosmos, 68: 743-764 (Aug.) 1926; IV. (Cast Gold Alloys), ibid., 69: 1007-1026 (Oct.) 1927. Souder, Wilmer: Selection of Dental Materials, J.A.D.A., 14: 189-199 (Feb.) 1927; Dental Gold Alloys, ibid., 15 (April) 1928. Analysis of Dental Gold Alloys; Methods of Analysis, Bureau of Standards Scientific Paper No. 532; price 10 cents. Reprinted J. Dent. Res., 7 (Dec.) 1927.

ject of the research, namely, to establish the physical properties of certain dental materials included within the scope of this program and methods for testing materials designed for similar uses which may be developed in the future has been accomplished and the results given to the profession and to all others interested. Dental schools and testing laboratories may now select materials appropriate for the definite types of restorations and be assured of a safe method for manipulating the materials selected.

The cooperating laboratory has made it possible for the Bureau to complete this work and, although the time required has been six years instead of two or three as anticipated in 1922, the Weinstein Laboratories have never hesitated to maintain a sufficient number of research associates at the Bureau and to bear their part of the expenses necessarily incurred. A conservative estimate of these items places the cost of the research to the cooperating laboratory at $50,000.

Recently, when this research was being completed, the Weinstein Laboratories expressed their willingness to prepare a new program to include additional items and problems of interest to the profession. In view of the most satisfactory relations during the last six years, I am sure this work could have been successfully arranged and carried out in this manner, and the Bureau very much appreciated this offer.

However, another proposition had also been received, from the American Dental Association through its Research Commission, and this was also being given consideration by the Bureau. This organization, commending the work already done, offered to share expenses with the Bureau in the carrying on of the new research program. As this offer was made by the organized profession and at the time when the original program was completed, it appeared that the Bureau should accept this cooperation and consequently discontinue further cooperative work with the Weinstein Laboratories. Therefore, the Bureau has decided to proceed in this manner and the new research program will be carried on hereafter in cooperation with the American Dental Association. I feel that this enlargement of the scope of the investigation is necessary and proper and that the burden of financing this cooperative program may appropriately rest on the individuals for whose benefit the work is being carried on.

The Bureau has, in fact, been in communication with the American Dental Association in regard to the matter of a cooperative research since Sept. 27, 1921, but prior to 1928 the Association has not seen its way clear to cooperate, financially, in this work.

The full cooperation of all parties interested in this new program is anticipated. Suggestions regarding the Association's part in this work should be made through its Research Commission. Communications should be addressed to Dr. L. L. Barber, Toledo, Ohio, chairman of the special committee representing the American Dental Association in this research.

A QUALITATIVE AND QUANTITATIVE CONSIDERATION OF THE CELLS IN NORMAL BLOOD: PART 1*

By IRWIN A. EPSTEIN, D.D.S., St. Paul, Minnesota

SINCE the introduction of methods for studying and counting blood cells, it has become common knowledge that there is a fairly constant number of the various types of cells found in the peripheral blood stream during health; and that there are distinctive changes which occur during various types of disease. Hematology, which deals with the blood and activities of the blood-forming tissues, has established for itself a definite field of usefulness in the practice of medicine and surgery by aiding in diagnosis in some cases, indicating prognosis for others and supplying complete diagnoses in a third group, when the examinations were made without the usual high error of routine practice and the findings interpreted according to hematologic principles. Frequent references are being found regarding the practical application of blood findings in the practice of dentistry, and there are those who believe that dentistry can profit by the application of its principles.

Physicians, pathologists and dentists offer varying opinions regarding the clinical significance of the hematologic findings. Rhein[1] tells us that there must be a thorough understanding of the blood examinations, which must be utilized not only in diagnosis but also after completion of operative procedures. Smith[2] states that counting of the leukocytes is one of the best established aids that the laboratory can furnish. Wolff[3] points out that both a high and a low count have significant value. He believes that "An increased white count is valuable from both a diagnostic and a prognostic standpoint. It shows the presence of infection and the amount of personal resistance of the patient. A low leukocyte count signifies low resistance. This count is important in many dental conditions, as it gives notice that some sort of stimulative treatment will assist the actual dental treatment in obtaining a quicker and better result." In Tice,[4] it is claimed

*Read before the Section on Histology, Physiology, Pathology, Bacteriology, and Chemistry (Research) at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

*From the Hematological Laboratory, Department of Animal Biology, University of Minnesota. Hematologic studies are under the direction and supervision of Dr. Hal Downey of the Department of Animal Biology. This work is being aided by a grant from the Scientific Foundation and Research Commission of the American Dental Association.

1. Rhein, M. L.: Dent. Cosmos, 68: 971 (Oct.) 1926.
2. Smith, J. H.: Dent. Cosmos, 68: 959 (Oct.) 1926.
3. Wolff, M. B.: Clinical Laboratory and the Dentist, Dent. Cosmos, 68: 911 (Sept.) 1926.
4. Focal Infection in Tice's Practice of Medicine, Hagerstown, Md.: W. F. Prior Co., Vol. 1, p. 303.

that the blood picture is of value in determining the presence of a focus of infection.

In acute focalization there is usually a polymorphonuclear neutrophil leukocytosis associated with red cell destruction. In focalization of the subacute and chronic types there is usually a low color index, with a moderate decrease in the red cell count. The total leukocytes are, as a rule, increased from 9,000 to 12,000. In the subacute type of infection leukocytosis often reaches 20,000 cells per cubic millimeter, even in the absence of noticeable suppuration. This picture of chloranemia and moderate leukocytosis in the absence of plainly demonstrable causes should suggest the presence of localized infection in the body. Frequently, however, "walled-off" chronic foci of infection will cause no change in the total numerical count of leukocytes. In such cases, as well as those exhibiting a moderate leukocytosis, the determination of the actual number and percentage of the various forms of leukocytes in the circulatory blood is of value. Importance is attached to the lymphocyte count, since chronic foci of infection produce a more or less constant irritation of the lymphoid tissue. Dependent upon the strength and type of the endotoxin, there is either stimulation or destruction of lymphocyte development. The differential count, therefore, is of importance.

Sondern,[5] Gibson,[6] Wilson,[7] Walker,[8] Jones,[9] Harvey[10] and others believe that the condition of the patient is shown by body resistance indices which they derive from total and differential cell counts. Goadby[11] believes that the result of blood examinations "points to the possible infecting agent," while Torren[12] and another small group maintain that there are alterations in certain blood cells which are specifically indicative of dental infection. On the other hand, there are those who believe that blood examinations serve no purpose in dentistry. Barker[13] voices this opinion by stating that "too little is known regarding the significance of this relationship to permit of dogmatic assertions, regarding either the existence of focal infection or the reduction of natural resistance to infection." Much effort has been devoted toward finding some means by which a diagnostician can tell by laboratory examinations whether or not a patient is absorbing harmful bacterial toxins from latent infection in and about the teeth and jaws, but so far none have shown sufficient merit to be extensively adopted as a reliable clinical guide.

The purpose of this work was to establish a biometric check of the blood found in individuals who were as nearly as it is possible to determine free from

5. Sondern, F. E.: Present Attitude of Blood Examinations for Diagnostic Purposes, Boston M. & S. J., 153: 690-692, 1905.

6. Gibson, C. L.: Value of the Leukocyte Count in Acute Surgical Conditions, Am. J. Surg., 43: 485, 1906.

7. Wilson, L. B.: Value of Sondern's Leukocyte Resistance—Line in the Diagnosis and Prognosis of Acute Appendicitis, Collected Papers, Mayo Clinic, 1905-09, Philadelphia: W. B. Saunders Company, p. 280.

8. Walker, O. J.: Index of Body Resistance in Acute Inflammatory Processes Indicated by Examination of the Blood, J.A.M.A., 72: 1453 (May 17) 1919.

9. Jones, W. C.: Clinical Significance of Total and Differential Leukocyte Counts, with Special Reference to Acute Infections, Am. J. M. Sc., 164: 553, 1922.

10. Harvey, H. E.; LaFevre, H. B., and Heselton, S. P.: Blood Cell Counts in Dental Infection and the Derivation from Them of a Numerical Health Index, J.A.D.A., 13: 331 (March) 1926.

11. Goadby, Kenneth: Diseases of the Gums and Oral Mucous Membrane, Ed. 2, Oxford Medical Publications, 1926.

12. Torren, J.: Diagnosis of Oral Infection by Blood Examination, Dent. Cosmos, 64: 917 (Sept.) 1922.

13. Barker, L. F.: Relation of Oral Sepsis to Disturbances of General Health with Comments on the Controversy Regarding Pulpless Teeth, Dent. Cosmos, 69: 1 (Jan.) 1927.

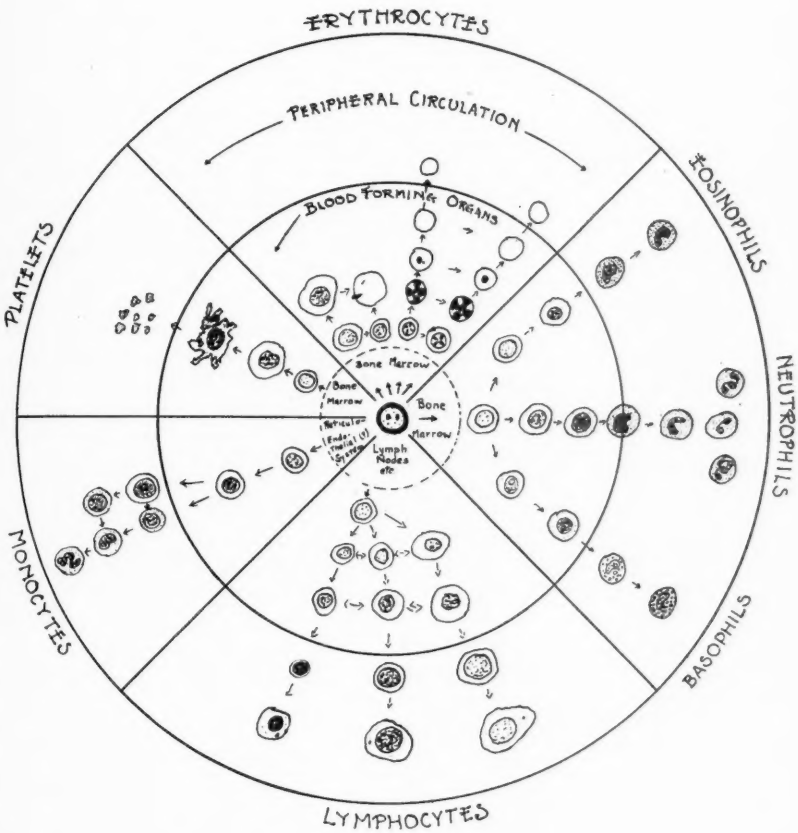


Fig. 1.—Chart representing the general scheme of the (monophyletic) theory of the development of the blood cells. The cell in the center represents a common parent type found in all the blood-forming organs and gives rise to the various types of blood cells. These pass through definite stages in the ripening process to produce their adult forms. The scheme as shown here for the lymphocytes takes place only during pathologic conditions. Normally, the lymphocytes are produced by division of preexisting lymphocytes. The cells in the inner circle represent the activities of development which take place in the blood-forming organs, while those in the outer circle represent the mature forms which can be found in the peripheral circulation. It can be easily seen from this diagram how stimulation to the entire system or any part of it will increase or decrease the usual numbers of cells, or alter the proportion, or produce changes in the character of the cells, this depending on the kind and intensity of the stimulus.

all types of ailments, and to obtain findings which could be used as a normal standard in further studies in the fields of acute and chronic infections. This will aid in determining the changes caused by dental infection *per se*, and can be used as a basis of comparison for observations on other types of infection, to determine to what extent such changes are characteristic or specific. In addition to total and differential cell counts and hemoglobin determinations, a thorough study of the characteristics of the cells themselves is attempted. This is the first of a series of studies to determine the value of hematology to dentistry. The object of this paper is to present findings concerning the cells in normal blood.

THEORY OF THE BLOOD PICTURE

The blood picture is the resultant expression of the combined activities of the hematopoietic system; in other words, what we find in the blood stream is merely the indication of what is going on in the blood-forming tissues. The principles underlying the interpretation of the blood pictures cannot be understood without a discussion of some of the basic theoretical considerations which involve their production and the influences which alter them. It is neither possible nor desirable to review the literature on blood production in detail, but a schematic drawing is presented (Fig. 1) to show something of the origin and development of the blood cells. Although this is a separate problem, it should receive attention because the life history of the cells must be understood under normal as well as pathologic circumstances, in order to comprehend the significance of varying cell characteristics or alterations in the number of cells in the circulation. Some hematologists believe that there can be found a polyvalent parent cell, or closely related cell or its equivalent, which has potentialities of differentiating into any of the various types of blood cells. These cells are found distributed throughout the myeloid, lymphatic and reticulo-endothelial (?) systems, and give rise to megakaryocytes, lymphocytes, erythrocytes and leukocytes. It is in these tissues that the cells arise and pass through definite stages of maturation until they are ready for introduction into the blood stream. Downey[14] has recently shown that, in the human being, there are normally no stem cells in the lymph nodes, and the lymphocyte production is carried on by division of mature cells. Lymphocyte development under pathologic circumstances does follow the outline as indicated by the chart.

Normally, the red cells, leukocytes and megakaryocytes (platelet-forming cells) are formed only in the marrow, but they may be formed in the other blood-forming tissues in pathologic conditions.

The cells which circulate in normal blood are adult forms of their type, and are found in numbers which stay within certain limits for each type. To what extent this normal formula remains uniform depends on the nicety of balance in formation of cells by the blood forming tissues, and subsequently their introduction and removal from the circulation. Normally, this cycle is completed at a rate which enables this balance to be maintained with a fairly constant degree of stability. Stimula-

14. Downey, Hal: The Myeloblast—Its Occurrence Under Normal and Pathologic Conditions, and Its Relations to Lymphocytes and Other Blood Cells, Folia Haematol., 34: 65 and 145, 1927.

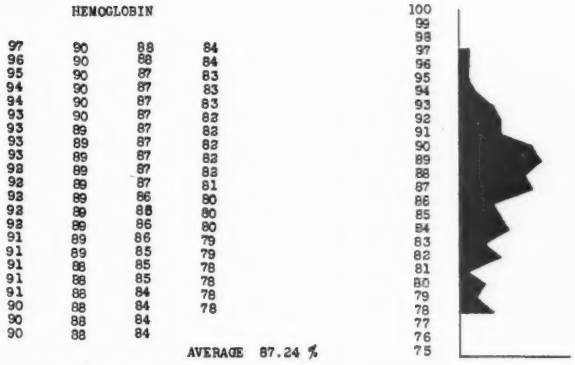


Fig. 2.—Hemoglobin readings (this series). Two complete hemoglobin determinations were made on each patient. The figures were arranged in order from highest to lowest. The diagram at the right represents the frequency distribution of the readings. Note the wide range of values for normal with the greatest bulk lying between 81 and 92.

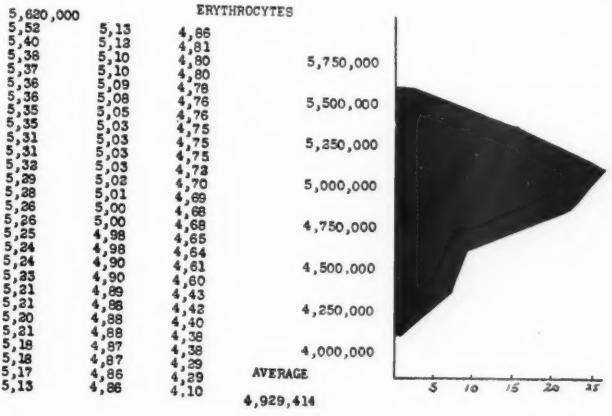


Fig. 3.—Erythrocyte counts (this series). Two complete total red cells counts are recorded here of each case. They are arranged in order from highest to lowest. The diagram on the right represents the frequency distribution of counts.

tion, as the result of increased functional demand to any part of these systems, can increase or suppress their activities, this depending on the intensity of the stimulus. This may result in a change in the absolute number of cells, alter the usual proportion of different types of cells or produce changes

in their structure. If the exciting agent is of such a degree as to stimulate these activities, the result will be an added production or an increase in the absolute number of cells, or will increase the relative proportion of one or more types of cells. The same stimulant of different intensity might suppress the activities causing a decrease in the absolute number of cells or a decrease in one or more types of cells to alter the relative proportion. Carried to an extreme degree, the outcome can be exhaustion of the blood forming organs, at which point they are not capable of functioning sufficiently to support life. Coincident with the above mentioned changes, the cells themselves may exhibit evidences of (1) increased functional activity (increase in cytoplasm, appearance of vacuoles, increase in nuclear lobulation); (2) normal regeneration (immaturity); (3) pathologic regeneration (cell structure indicating misdirected development), and (4) degeneration (coalescing of the chromatin network in the nucleus causing a blurring of the nuclear pattern, fusion of nuclear segments, pyknosis of the nucleus, development of granule-free spaces, alteration of size, shape, number, staining reaction and distribution of granules; alteration in size, and shape of cells, change of position of the nucleus in the cytoplasm, and fragmentation of cells).

Many attempts have been made to determine the factors which are responsible for changes in the total number and proportion of cells. Climate, geographic location, condition of metabolism, previous disease, blood pressure, vasomotor activities which cause uneven distribution of the cells between the various vascular beds, characteristic tidal rhythms, intense cooling and heating, sudden change from a recumbent to an upright position, muscular exercise, increased heart activity, digestion of food, occupation, constitution, manner of life, age, time of day, altitude, seasons, sex, menstruation, technic, personal equation and onset of death are among the possible causes which have been investigated. In many of these works, little or no mention is made of the character of material which was used for these determinations, and many of these experiments can be discounted because they were improperly controlled or control groups were entirely lacking. It is apparent that there are numerous factors which govern the activities of the hematopoietic system at any one time, and that these influences are expressed as quantitative and qualitative variations in the circulating blood.

The extent to which this variation can exist in the structure of the blood cells during health should be understood in order to detect and interpret the subtle changes which may be caused by the milder disease processes. Since the tendency among hematologists is to emphasize the importance of the qualitative alterations as well as the quantitative side of the problem, a recheck of normal blood is thought to be justifiable. Arneth,[15] Schilling[16] and others have done a tremendous amount of work on the qualitative blood picture, which has proved its worth in many of the infectious diseases when total and routine differential counts would not reveal usable information. Analysis of cell structure has been the solution to differentiation between lymphatic leuke-

15. Arneth, Joseph: Qualitative Blood Count, Leipsic: Klinkhardt, 1920.

16. Schilling: The Blood Picture and Its Value, Ed. 3 and 4, Jena: Gustav Fischer, 1924.

mia and acute benign lymphadenosis. Downey and McKinlay[17] have pointed out that the difference between a deadly disease and a harmless process whose clinical picture and total and differential blood cell counts are practically identical can readily be shown by individual cell characteristics. Piney[18] emphasizes the fact that the size of a blood count is not the feature on which most stress is to be laid, just as the size of a tumor can give little information as to its nature. He states that the one method of real value in diagnosis must depend on detailed examination of the constituent cells. This method is admitted in regard to neoplasms, and he has shown that the same technic must be used in the examination of the blood. Cases have frequently been reported in which the total counts were well within the limits of normal, while the patient exhibited severe clinical symptoms. Histologic examination of the cells in these cases has shown alterations which were in keeping with the clinical symptoms, but which returned to normal with the improvement of the patient. These cases support the contention that the one method of value in making blood examinations is detailed examination of constituent cells.

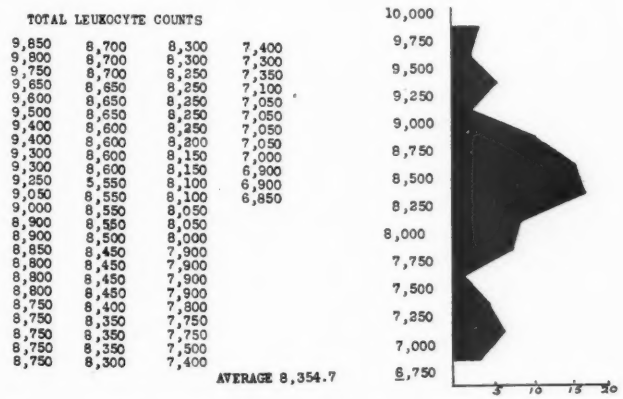


Fig. 4.—Leukocyte counts (this series). Duplicate counts of each case are recorded here in order from highest to lowest. The diagram on the right indicates the frequency distribution of the leukocyte counts.

LITERATURE

The literature on normal blood confronts one with a maze of material. Although there is a general uniformity of opinion, the variation is wide enough to warrant attention. The values for hemoglobin vary greatly in accordance with the type of material and the class of instruments used. Total red cell counts are quoted almost uniformly to be in the neighborhood of 5,000,000

17. Downey, Hal, and McKinlay, C. A.: Acute Lymphadenosis Compared with Acute Lymphatic Leukemia, Arch. Int. Med., 32: 82-112 (Jan.) 1923.

18. Piney, A.: Importance of Hematology in Surgery, British J. Surg., 14: 145 (Aug.) 1926.

cells per cubic millimeter. The observations on the total numbers of leukocytes extend from 2,000 to 14,950 cells for the same volume. The differential counts vary because of the many existing classifications into which the cells are divided. The figures given above, as well as those used in compiling

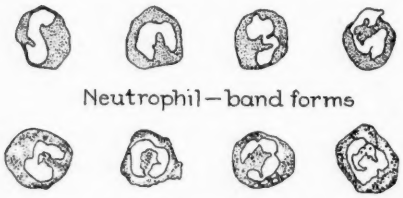


Fig. 5.—Polymorphonuclear neutrophils. (All drawings of blood cells were made with the aid of the camera lucida to the same scale.) These cells are representative of the band forms. Note that there may be constriction at portions of the nucleus. There are no fine strands such as separate the lobes in the segmented types. (Fig. 6.) Colored lithographed plates only will reproduce faithfully the actual appearance of stained blood cells. It is impossible to bring out nuclear characteristics in black and white diagrams; hence, the nuclear pattern has been left white. Note the difference in size, shape and distribution of granules in the toxic forms. Note the presence of vacuoles in the third cell from left in lower series. Toxic forms in all plates were taken from individuals passing a physical examination as normal and having a manifestation of dental infection.

the charts, were taken from standard works on hematology, medicine, laboratory diagnosis, physiology and anatomy, and from current scientific magazines.

Ordinarily, there is no description of the individuals used to determine the figures given for normal. Lippincott,[19] reporting 3,045 counts, says that they were made on hospital and clinic patients, many of them as part of routine laboratory examinations. Records were taken as they came, no attempt being made to pick cases. Miller,[20] reporting 650 differential counts in an attempt to verify Bunting's work,[21] uses students designated as normal individuals. Bunting's examinations were made on medical students and laboratory assistants.

They were all in daily attendance upon university work, all apparently in health and unconscious of any illness. Several of them were athletes in training. While the majority of the counts were made in the spring months, the rest were sufficiently scattered throughout the year to seem to indicate that season was not a factor. As a rule the counts were made just before the noon hour.

Mehrten's[22] paper, in 1908, reported findings on 100 people who were selected with the view of including outdoor as well as indoor workers, females as well as males, and of the ages between 21 and 50; in short, to approximate as nearly as possible the average individual appearing in the clinics and hospitals. Among those examined were physicians, students, nurses, soldiers and such miscellaneous people as could be procured from time to time. All were in their usual state of health, care being taken to exclude those having recent illness. Shaw's conditions of experiment were:

All the subjects were starved of food and fluid over night and kept in a state of physiologic rest throughout the experiment. At

19. Lippincott, L. S.: Blood Counts in Mississippi, J. Lab. & Clin. Med., 11: 524 (March) 1926.

20. Miller, S. R.: Normal Differential Leukocyte Count, Bull. Johns Hopkins Hosp., October, 1914, p. 317.

21. Bunting, C. H.: Normal Differential Leukocyte Count, Am. J. M. Sc., 142: 698, 1911.

22. Mehrtens, H. G.: Frequency of Low Polymorphonuclear Leukocyte with High Lymphocytic Differential Counts, Arch. Int. Med., 12: 193, 1908.

least a half hour's rest was enjoined before the experiment began. The room temperature was kept as uniform as possible. The effect of digestion was tested by giving an ordinary mixed meal containing abundant protein, fat and carbohydrates.

MATERIAL

There appear to be two groups of factors to which the variation in findings may be due. They may be considered as a first group, which cannot be controlled, and a second group, which can be controlled. Included in

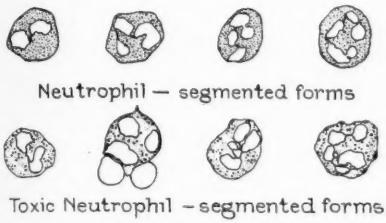


Fig. 6.—Polymorphonuclear neutrophils; segmented forms. Most of the neutrophils belong to this group. The lobes are connected by fine connecting strands. Note the variation which occurs in the toxic types (as mentioned above). Two red cells were outlined to show the relative sizes of the cells in all drawings to them.

the first group are effects of vasomotor activities, uneven distribution of cells between the various vascular beds, constitutional differences, normal tidal rhythms, technic and the personal equation. The controllable factors have to do with material and conditions of experiment. In this series of forty-two cases, the following features were noted:

1. Sex: Male.

2. Age: The average age is 21.348 years, lying between the limits of 18 and 33 years.

3. Manner of life and occupation: Students.

4. Altitude: Seven hundred and nine feet above sea level.

5. Geographic location: These individuals had all been in residence about the University of Minnesota for approximately three months.

6. Season: All blood was taken during the winter months.

7. Time of day and digestion: All blood was taken early in the morning before breakfast. Each student had been instructed not to eat anything after supper the previous day.

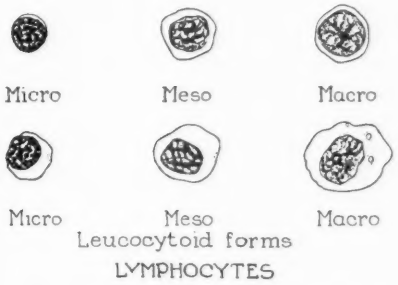


Fig. 7.—Lymphocytes. In the types of lymphocytes, there is usually a variation in the characteristic lymphocytic structure of the nucleus. In the micro type of cells, the chromatin strands appear like heavy cloud-like masses. In the meso type, the chromatin network tends to become more diffuse. The macro type has a few large masses of chromatin in the nuclear pattern. The lower three figures show the three types in which there has been an increase in cytoplasm. These are the leukocytoid forms. In any of the six types, azure granulation and vacuoles may be found.

8. Muscular exercise and increased heart activity: No reason for any increase.

9. Previous disease: Any case showing a history of appendicitis, gonorrhea, rheumatism, tuberculosis, frequent colds, cough, ear trouble, sore throat, constipation, diarrhea, indigestion, palpitation

of the heart, shortness of breath, headache, frequent or painful urination or skin trouble was ruled out.

10. Pathologic state: Any cases which presented discharge from eyes, ears, nose or throat, hypertrophied or pathologic tonsils, enlarged thyroid or lymph glands, discharge from genitals, sugar or albumin in the urine or lung or heart conditions were excluded. (I am indebted to the officials of the University Health Service for access to the medical records of the students for use in this work, and to George Fahr of the school of medicine for his advice and

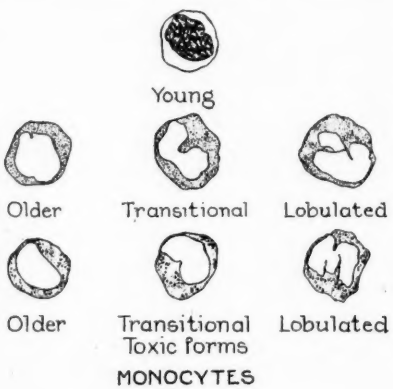


Fig. 8.—Monocytes. The monocytes are divided into young, older, transitional (indented) and lobulated forms. Toxic variations are shown of the older, transitional and lobulated forms.

time in making medical examinations.

11. Dental infection: Each case had an examination, made by myself, of the hard and soft tissues of the mouth, including a 14-film roentgen-ray examination, and vitality tests where indicated. Any indication of dental disturbances such as gingivitis, pyorrhea, partially erupted teeth, teeth with deep fillings not responding to a vitality test, teeth which showed any evidence of root canal treatment or any other condition which might be associated with infection ruled a case out. The final group of forty-two was selected out of the entire freshman class of several hundred students.

TECHNIC OF MAKING BLOOD EXAMINATIONS

All samples of blood were taken from punctures in finger tips, made with an automatic lancet. These were deep enough to produce a free flow of blood without the assistance of pressure to the parts. Hemoglobin determinations were made by the Sahli method, the improved type of instrument which has nonfading color standards made of semaphore glass being used. Two complete red and white cell counts were made in a United States Government standardized Levy-Hauser counting chamber provided with the improved Neubauer ruling. All smears were made by the two cover slip method, stained with Wright's stain (Gruebler's) and mounted as described in a previous paper.[23] Figure 2 presents hemoglobin findings; Figure 3, erythrocyte counts.

MORPHOLOGY OF ERYTHROCYTES

During examination of the stained blood film, the red cells pass in a continuous stream over the field. In studying them, attention is paid to the variation in shape, size, color and distribution of hemoglobin. The red cells are nonnucleated sacs or vesicles which are filled with the respiratory pigment, hemoglobin. The greatest bulk of them are round. Occasionally, in portions of the smear, they will tend

23. Epstein, I. A.: Study of the Blood in Cases with Dental Infection: Preliminary Report, J.A.D.A., 13: 1752 (Dec.) 1926.

DIFFERENTIAL FORM FOR QUALITATIVE ANALYSIS OF LEUKOCYTES

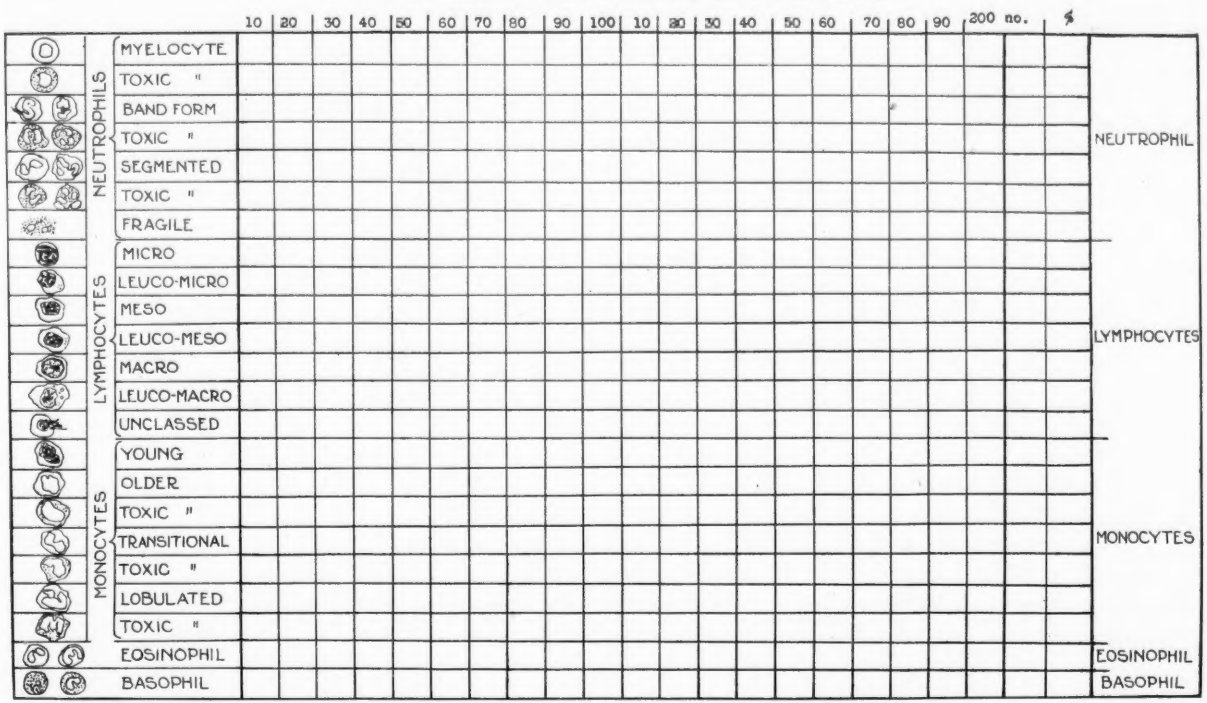


Fig. 9.—Differential form for the qualitative study of leukocytes. Opposite each division, there appears a drawing of the type of cell intended to be recorded. Provision is made for recording absolute numbers and percentages for each type as well as percentages of the five major cell types. The extent of qualitative changes as well as the quantitative alterations are readily discerned by this type of analysis.

to be slightly oval or may have a slight point extending from the rim. The long axis of such cells usually points in the same direction, indicating that the distortion is due to mechanical injury. The size of the cells shows some variation, although the bulk of them are monotonously uniform. The variation will usually not exceed one fifth of a diameter more or less than the average cell size. Gram[24] quotes the measured variation to be between 6.7 and 9.3 microns. Ewing[25] states that from 75 to 90 per cent of the cells fall between 7 and 8 microns. If the films are not dried quickly after the smear has been made, many of the red cells will become small and shriveled. This will also disturb their shape by causing the outer surface to become pointed with projections of the cell membrane so that their appearance becomes burlike.

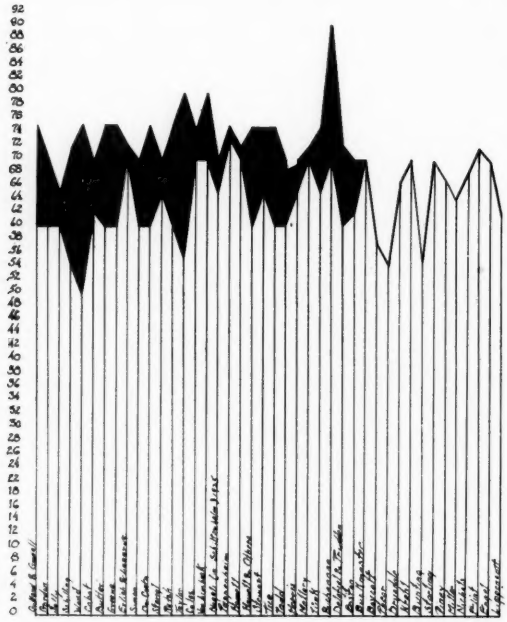


Fig. 10.—Findings on the normal percentages of neutrophils in the literature. There is an interesting variation of opinion, as shown by the shaded areas.

Variations in color occur as the result of slightly variable amounts of hemoglobin contained in each cell. In the

24. Gram, H. C.: Normal Human Blood: Composition and Physical Properties. A Compilation of Values, Am. J. Med. Sc., 168: 511 (Oct.) 1924.

25. Ewing, J.: Clinical Pathology of the Blood, New York: Lea Bros. and Co., 1903.

blood of the same patient, there is little variation in color between the individual cells. The cells may appear various shades of light pink, this depending on the amount of hemoglobin they contain.

After going over the blood of many patients which has been stained by a standardized technic, it is possible to estimate fairly closely the amount of hemoglobin in that blood. Structurally, the red corpuscles are biconcave discs. Because of this, there is a general shading off of the color from the

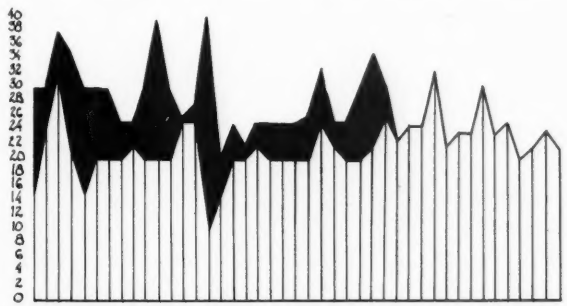


Fig. 11.—Findings on the normal percentages of lymphocytes in the literature.

cell to the center. In the thinner parts of the smear, the cells practically all correspond to this description. Out at the edge of the smear, cells can be found which seem to be a deep pink throughout. As these cells practically always can be found in groups, this can be regarded as being caused by overstaining. Attention to these types of variation is important in the consideration of pathologic blood. The accompanying table gives the observations on the normal number of leukocytes by various authors. Figure 4 shows the findings in this series.

MORPHOLOGY OF LEUKOCYTES

The classification of leukocytes is based upon the analysis of the morphology of the cells.

1. Nuclear analysis: Here, the nuclear pattern is of importance and is determined by the total amount of chromatin, relative amount as compared with parachromatin, the arrangement and staining reaction of the chromatin and parachromatin, the outline of the nuclear membrane and the size of the nucleus.

2. The cytoplasm is examined for staining reaction, presence of vacuoles, presence or absence of granules, character of granules when present, i.e., shape, staining reaction, size, number and distribution.

3. Position of nucleus in the cell.

4. Relative size of nucleus to cytoplasm.

5. Relative sizes of cells.

Five varieties of cells can be identified, and these can be subdivided according to varying attributes as outlined above.

The polymorphonuclear neutrophils can be divided into three distinct types of intact cells and a fourth group composed of damaged or fragile cells. The

first of these is composed of the most immature neutrophils which are found in normal blood. It is the same size as the other forms and has the same nuclear pattern and the same type of granulation, but the nucleus is round. This cell, the myelocyte, is not found in all cases, and when found, it occurs only to the extent of one or two cells in the thousand counted. The second type of neutrophil which occurs is identical in every respect to the other forms except that the nucleus is drawn out into a bandlike form without segmentation (Fig. 5). The third type, which represents the most mature or the adult form, has the nucleus divided into two, three, four, five or six small lobes which are connected by fine strands (Fig. 6). The greatest number of neutrophils belong to this class. The fourth form includes the fragile types. Here and there about the smears can be found single cells that have ruptured cell membranes, distorted nuclei and scattered and stained granules. The character of the granules usually helps to identify the cell type. The fact that these cells are surrounded by intact cells seems to indicate that the original condition as well as damage from manipulation during technic has a bearing on their presence. There seems to be a difference in the resistance to handling in different blood specimens. This has been noticed also by other technicians. It is a difficult thing to make usable smears of blood which contains enough intact cells to permit of examination. There seems to be this difficulty in normal as well as in pathologic blood. Occasionally, cells can be seen which have granule-free spaces in the cytoplasm; some granules which seem to be larger and more deeply stained, and fewer granules in the entire cell than are found in the bulk of the cells. These changes occur as the result of increased functional activity or the direct action of toxins on them, and are seen to occur in the myelocyte, band and segmented forms, and may be designated as toxic variations of these forms.

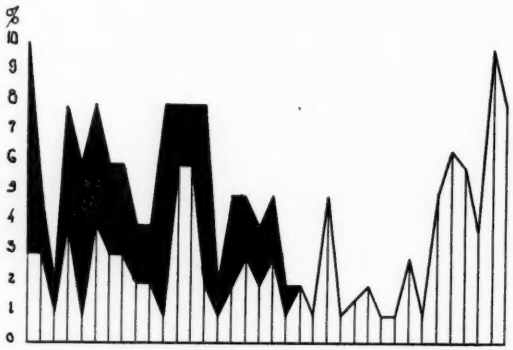


Fig. 12.—Findings from the literature on normal percentages of monocytes.

The nuclei of the eosinophils are either bilobed or trilobed. Occasionally, one is seen with four lobes, which are connected by broad connecting strands. The cytoplasm is a faint blue

LEUKOCYTE VALUES AS FOUND IN THE LITERATURE*

OBSERVATIONS OF NORMAL NUMBERS OF LEUKOCYTES

Author	Aver.	Max.	Min.
Welker	14,000	14,925	12,857
Moleschott	13,300	14,000	12,605
Malassez	5,000	7,692	3,750
Graucher	6,000	9,000	3,000
Hirt	8,388	10,590	6,784
Thoma, Lyon	5,464	7,066	4,430
Halla	7,533	10,106	4,960
Tumas	6,200	9,600	4,800
Patrigeon	6,000	10,000	2,000
Limbeck	8,500	9,000	8,000
Adults	7,680		4,200
Rieder—Children	9,960	12,400	7,200
Reinert—6 a. m.	5,125		
4 p. m.	8,262		
Gulland & Goodall	7,000	9,000	5,500
Gordon	7,500	9,000	6,000
Jolly	7,000	10,000	4,000
Schilling	7,000	8,000	6,000
Ward	7,000	8,000	6,000
Cabot	7,575	10,500	5,000
Butler	7,500	10,000	5,000
Greene	7,500	10,000	5,000
Bunting	7,000	8,000	6,000
Miller	8,000	10,000	6,000
Howell	6,000	7,000	8,000
Drinker	8,000	10,000	6,000
Piney	7,000	8,000	6,000
Morris	7,500	10,000	5,000
Türk	7,500	9,000	6,000
Buckanan	7,500	10,000	5,000
Nichols	7,000	8,000	6,000
French	7,000	10,000	4,000
Grawitz	7,500	10,000	5,000
Dominico	5,500	7,000	4,000
DaCosta	7,500	10,000	5,000
Samuel	14,000		
Duperie	4,545		
Hayem	6,000		
Sorenson		8,010	
Reinecke	7,351		
V. Jaksh	7,482		
Buckmaster	7,500		
Starling	8,000		
Schaffer	8,000		
Foster	6,000		
Flint	6,000		
Stewart	10,000		
Beddard	10,000		
Lippincott	7,639		
Mallory	8,000		
Boston	7,500		
Mehrtens	7,000		
Beckman	7,533		
Grosber	7,242		

*These figures were taken from standard textbooks on hematology, medicine, laboratory diagnosis, physiology and anatomy and from current scientific magazines. The range extends from a minimum of 2,000 per cubic millimeter to 14,925 for the same volume.

in some cells; in others, the color is not seen because the eosinophilic granules are so closely packed together.

Most authors divide the lymphocytes according to the relative sizes of the cells, into three classes: the small, the medium and the large. Basing the classification on cell characteristics, six groups can be distinguished (Fig. 7). The microlymphocytes are usually the smaller ones, in which the chromatin is more or less blocked in clouds which fade out into the parachromatin. The cytoplasm is a very narrow rim of blue, which may vary in intensity from a very light to a very deep shade. The nucleus is practically always in the center of the cell, though it may be placed slightly eccentrically. In the mesolymphocyte, the nucleus has apparently swelled so that there is a looser network with relatively more parachromatin showing. The cell may be larger, but the proportion of nucleus to cytoplasm, position of nucleus and staining reaction of the cytoplasm remain the same as in the first type. As the result of still further growth, the macrolymphocyte presents a nucleus with few chromatin masses. The structure is fine, with about as much parachromatin as chromatin showing. Although these cells are large, the proportions remain the same as in the above mentioned types. Any of the three forms of these cells, on aging, can develop more cytoplasm and become leukocytoid. In these forms, the cytoplasm becomes more hyaline, so that the color is very pale blue. In all the leukocytoid forms, the relative amount of cytoplasm to nucleus is greater than found in the foregoing types. In any of the lymphocytes, azure granulation may become more abundant, vacuoles may appear or the cells may become larger. In some cells, the nuclear membrane has been ruptured. This disturbs the typical nuclear structure, necessitating the creation of a group called unclassified lymphocytes.

Of all the cells, the monocytes have been classified in more ways than any of the other types of cells. This is no doubt due to the fact that their origin and relation to the other blood cells has not been so well understood as are the others. Morphologically, the monocytes are a distinct cell type characterized by a specific nuclear structure. (Fig. 8). The arrangement of chromatin gives a striped appearance to the nucleus, which differs from that of any of the other cells. In the younger forms, the cytoplasm is a light blue similar to that found in the leukocytoid forms of lymphocytes. It is often difficult to distinguish between them unless attention is given to the inner structure of the nucleus. The nucleus is round or slightly cuboid. In the older forms of monocytes, the chromatin strands are slightly more distinct from the parachromatin. The cytoplasm is gray or slate-color, containing an azure granulation which is different from that found in the lymphocytes. It is fine and dustlike, giving the cytoplasm a ground-glass appearance. Many monocytes possess indented nuclei. Another group of them are definitely lobulated. With the exception of the young forms, all types have occasional cells which have some vacuoles, and irregularity in the size and staining reaction of the azure granules, associated with some thickening of the chromatin strands in the nucleus. Such forms are classified as toxic variations.

RECORDS

For the purpose of recording the observations, a differential form was

arrived at, which could be used in connection with the classification of cells outlined above. It is designed to summarize absolute numbers and percentages of the five varieties of cells and their modifications. One thousand cells were studied from each case. The sample sheet shown here is drawn for 200 cells (Fig. 9). Findings from the literature on the percentages of neutrophils, lymphocytes and monocytes are shown in Figures 10, 11 and 12, respectively. Because of the short time for presentation and since new material from young women and older men and women is to be added, a detailed report of the findings will be reserved for complete biometric treatment.

CONCLUSIONS

1. The number of males of 21 years who are entirely free from all types of infection is very small.

2. Material for establishing normal blood standards can be selected and conditions of experiment controlled.

3. For purposes of studying cell characteristics, the cells should be subdivided as much as is warranted by classifications clearly established.

4. Normal blood is found which is difficult to smear because of fragility of the cells.

5. Normal leukocyte values extend from 6,850 to 9,850 cells per cubic millimeter in this series.

6. Normal hemoglobin values (Sahli) extend from 78 to 97.

7. Normal red cell counts lie between 4,100,000 and 5,620,000.

8. The results of the differential counts tend to verify the results of Bunting,[21] Miller,[20] Mehrtens,[22] Guerro and Sevilla,[26] Chamberlain, Watkins, Hoxie and Lippincott,[19] in that the neutrophil percentages are lower and the lymphocyte percentages are higher than are classically ascribed for them. Lymphocytosis as a feature of focal infection loses its significance unless the count rises considerably.

9. In normal blood, there are a small percentage of cells which exhibit evidence of slight immaturity, increased functional activity and degeneration. Increase in round, band and toxic types of neutrophils; increase in young, lobulated and toxic forms of monocytes, and increase in leukocytoid forms of lymphocytes in the presence of undisturbed proportions of the major cell types should be recognized in analyzing the blood of patients with mild disease processes.

10. Because of the variability of total and differential counts, the histologic study of normal blood cells emphasizes the value of making blood examinations by detailed examination of the constituent cells.

26. Guerro and Sevilla: Philippine J. Sc., Series B., 1909, p. 277. (Quoted by Mehrtens.)

PRELIMINARY STEPS IN THE PREVENTION OF PYORRHEA*

By AUSTIN F. JAMES, D.D.S., Chicago, Illinois

THE underlying principle in the practice of periodontia should be to put all tooth surfaces in such condition that the patient may be able to keep them clean. In every mouth that comes under my observation, I find there are certain places from which no casual toothbrush manipulation could possibly remove the plaques, and it is doubtful that any special toothbrush technic could bring about satisfactory results.

"Preliminary steps in prevention," means, in my practice, not only to put every exposed surface of every tooth in condition, so that the patient can keep them clean, and teach the patient how to do so, but also to remove every other source of irritation. There is no possible correction of diet nor any knowledge that may be gained regarding systemic complication that will make it possible to ignore the local problems that arise in every mouth, preventing the maintenance of proper hygienic conditions.

Every periodontist has adopted some method of obtaining the desired results, and the degree of success attained has advanced the position of its followers to an established specialty. Much as I would like to do so, I shall not attempt to persuade my co-workers to adopt my pet method of accomplishing this result. However, it does seem that there should be more uniform methods established by the exchange of ideas at the annual meetings, and I see no way that this can be accomplished except by the establishment of a definite technic and one that can be taught to any dentist.

My method involves the arrangement of a set of instruments, making it possible to select an instrument that will have two points of contact on the tooth, the working blade being a square edge, using either the pull cut or push cut stroke, the shank of the instrument resting on the tooth anterior to the blade and using a leverage or fulcrum force to remove the roughened tooth surface or calcareous deposit. The instrument slides over the tooth surface, following the curve of the tooth. This type of instrument will not take hold unless there is something on the tooth surface to resist it. When the instrument ceases to cut, the operator will know that he has a smooth surface ready to take a polish.

The question arises: Do many dentists know or do many periodontists realize to just what degree a tooth will take a polish? It is my belief that many do not appreciate the importance of this

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*The papers of Drs. James, Bricker, Stillman and Weller, with a paper by Sherman L. Davis on "Diet," were presented as a symposium on "The Principles of Preventive Periodontia."

step, and strange as it may seem when we think of the microscopic structure of a tooth, the fact remains that either enamel or cemental surfaces will take a finish that can only be described as a burnished surface, and, when this is obtained, will remain in this condition throughout periods of more or less serious neglect. It is my experience and opinion that this result can be brought about only by hand polishing with the wood point in the porte polisher. It is a rubbing down process that can be accomplished only by a definite rubbing down stroke with the hand instrument and is the only method that can be used without some danger of doing damage to the tooth surface or injury to the tissue cells of the supporting structures. I have long since discarded the use of strips and tapes for polishing exposed cemental surfaces. After instrumentation and hand polishing, there are no complaints of hypersensitive tooth surfaces. Knife-edged instruments and files will cut excessively as long as there is tooth surface to be cut, and there are really few operators who do not overdo instrumentation with this type of instrument. It is my belief that much safer results can be obtained by the above described methods.

In any mouth in which there are unclean tooth surfaces and gingival inflammation, it is ridiculous to presume that there are diet complications or systemic conditions involved until everything has been done from the hygienic standpoint to clear up these areas.

In my practice, there are no preliminary steps in prevention further than determining that treatment is necessary. The proposition to the patient is that there are unsatisfactory tooth and gum conditions and that I will assume the responsibility of mechanically removing those conditions and at the same time will undertake to teach the patient the mechanics of keeping tooth surfaces clean and building up tissue cell resistance.

In more extreme cases, in which infection has occurred, the same method of instrumentation is carried to the depth of the pocket, and it is my opinion that men who are advocating radical methods or surgical treatment have not developed definite methods of root instrumentation or they would not employ such methods.

PROPHYLACTODONTIA*

By FREDERICK A. BRICKER, D.D.S., Hollywood, California

THE psychologic condition which exists between the dentist and his patient is ideal from the point of view of treating prophylactodontia, that branch of dentistry which specializes in preventing dental and oral disease and malformation.

To the average patient, visits to the dentist are disagreeable ordeals, owing to unpleasant memories of extractions and the painful procedure of acquiring fillings. When we put our foot on the

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electric switch which controls the drill, every muscle in the patient's body tenses. He is ready to be hurt.

This dread of the dentist's chair is akin to the dread of disease. Both suggest pain, and "false teeth" are about as welcome as artificial legs. If, then, we can make the dental chair a place of pleasant discussion of the means of preventing or at least delaying such unpleasant ordeals as fillings and extractions—the result of periodontoclasia—we will have turned our irksome patient into a happy, truth-seeking mortal, and advanced many strides in preventive dentistry.

The desire to live and to be free from disease is inherent in every people of every race. In order to arouse the public to its need for health betterment, it was necessary to advance a great deal of public health education through periodicals, state and local boards of health, the Red Cross, radio talks, etc. All these agencies took up the work, and public health improved accordingly. But none of the public or group methods will ever fill the place or show the gratifying results which can be obtained through individual teaching, and that is the opportunity which the dentist has even more than the physician, for the patient does not leave the dentist's chair until he is told to do so.

If the dentist, as he works, sketches an interesting outline of mouth hygiene and the prevention of disease, the patient will lend an attentive ear, as he is paying for such information.

There is, indeed, no better school for dentistry than a dental chair, with mirror, models, stain and toothbrush for the proverbial blackboard and chalk. Since visual memories predominate in most individuals, our word picture should be so clear that the patient gains a definite mental picture of what occurs during the following proper mouth brushing, and understands why the result is beneficial.

The value of the full mouth radiogram cannot be overemphasized, and, for every patient, the taking of a radiogram within a year should be insisted on. It is equally desirable to teach each patient to read his roentgen ray film, thus helping him to realize the actuality of the condition diagnosed, and thereby gaining his confidence.

When the patient has seen the radiograms, he is prepared to begin his lesson, which falls into eight parts. The eight things which he particularly needs to know are: 1. The causes of decay. 2. The causes of periodontoclasia. 3. That decay and periodontoclasia can be prevented by proper hygiene and diet, and by regular visits to the dentist. 4. That periodontoclasia is not a specific or contagious germ disease. 5. That the teeth will not stay healthy without care; that although the dentist can, at times, restore them to health, the patient must keep them healthy. 6. That the oral cavity is the seat of more focal infection than any other part of the body, and its available area for infection greater. 7. The fundamentals of diet as affecting teeth. 8. How to brush the mouth correctly.

Let us consider these eight teaching points in turn:

1. The causes of decay and periodontal disease. These can be effectively brought home to the patient by staining the surfaces of the teeth with a disclosing solution, so that he can see the bacterial plaques. Then, let him examine his teeth with the aid of a mirror, and explain to him the action of bacterial plaques in forming acids which disintegrate the enamel, and the fact that

deposits are formed by allowing these plaques to remain on the teeth.

2. The causes of periodontoclasia. Periodontoclasia is the breaking down of the tissues around the teeth. Explain to the patient that the principal cause of periodontoclasia, commonly called pyorrhea, in younger patients (from 19 to 30 years) is lack of proper care, and lack of sufficient activity in mastication, owing to the tendency toward the use of soft cooked foods. Later in life, the abnormal occlusal wearing of the teeth produces traumatic occlusion and periodontoclasia. Loss of teeth, inaccurate, unfinished, unhygienic restorations are also factors in the production of periodontoclasia (pyorrhea) in the adult.

3. Prevention of decay and periodontoclasia. Demonstrate that these conditions can be prevented by proper hygiene of the mouth and by the use of a suitable diet, including coarse, hard foods, fruits and toast. Regular visits to the dentist, as a preventive measure, should also be stressed.

5. Cooperation of the patient. Make plain to the patient that to cure means merely to restore to health, not to make immune; and that the permanent result depends on his daily efforts much more than on the occasional efforts of the dentist. Show him that not frequency of effort, but thoroughness of effort, in mouth-brushing as in business-building, will acquire the result desired; that the question is not only "How many times a day do you brush your mouth," but "How do you brush your mouth?"

6. The mouth as a seat of infection. Many patients realize that the mouth is a seat of infection, but few realize that it is the seat of more infection than is found in any other part of the body. A demonstration of how large an area is available in the mouth for infection is therefore very effective.

7. Fundamentals of diet as affecting teeth. "What has diet to do with teeth?" is so common an exclamation that it is important to explain that the mastication of fibrous foods, such as coarse breads, vegetables and fruits, is essential to the maintenance of oral health, as this mastication provides a natural massage of both gums and teeth. Also, the influence of acid and acid-forming foods should be mentioned.

8. Beginning of decay on one of three or all three surfaces of a tooth. These are the surfaces he did not reach with the toothbrush. They are the surfaces that include pits, fissures, interproximal surfaces and those around the gum margin. Salivary calculus forms at the same locations.

Visualize these surfaces when brushing the mouth.

These facts, which are commonplace to you and seem axiomatic, are new to many of your patients, and only partially clear to the rest. If you do not explain them in detail, you are doing both the patient and the profession an injustice, and holding back the health program of the nation.

With most patients, a realization of these eight truths results in real cooperation and intelligent effort. In the rare cases of continued indifference, an inventory of the teacher and the manner of presenting the lesson is more profitable than too severe criticism of the patient. Language is at best a faulty medium, and if our word pictures do not arouse interest, the fault may rest with our vocabulary rather than with the listener's intelligence.

I work on the foundation that good circulation is the definition of health. One of the essential lessons which I

teach is that of circulation, beginning with a consideration of the general circulatory system and gradually leading up to a discussion of the circulation in the mouth. I want my patient to know that the reason the professional masseur massages from the extremities toward the heart is because the arterial blood is under a pressure from the heart, forcing it into the tissues, while the venous blood is controlled largely by check valves in the veins, which as it is forced toward the lungs, prevent its return into the tissues. We have been teaching that massage brings arterial blood to the part, when really we are forcing out the venous blood and forming a vacuum for the arterial blood to fill. The blood for the teeth and their surrounding structures is carried to the apices of the teeth, and there the arteries are divided into several branches, one supplying the pulp, others the gums. The main blood supply of the root or periodontal fibers passes down between the root and the alveolar process to the gingiva. Thus, the circulation of the upper teeth is downward, and that of the lower teeth, upward. To help patients get a mental picture of the circulation in the mouth, it may be demonstrated on a model or in one's mouth. Certain questions are asked so frequently by patients that it may be helpful to list a few of them with suggested answers:

1. How stiff a brush should one use? As stiff as one can get. The gum tissue is the same as that covering the palms of the hands and soles of the feet, and the more the gums are massaged with the brush, the firmer they will become.

2. How hard should one brush? Brushing should be as vigorous as it can be without causing pain or discomfort. Up to that point, it stimulates circulation; beyond that point, it irritates. We want all the stimulation possible, without irritation.

3. What are the first symptoms of pyorrhea (periodontoclasia)? Symptoms which the patient will notice are inflammation and bleeding of the gums, sensitiveness to the brush, and, later, looseness of the teeth and tenderness of the teeth in biting.

4. What is the best dentifrice? All dentifrices should be considered for their scouring or abrasive properties, not as medicaments. I have no choice between the various commercial products, although I find it easier to teach proper mouth brushing and impress the need of stimulating circulation through the use of the following:

Precipitated calcium phosphate (tribasic)
Sodium chlorid
Precipitated calcium carbonate.
Sodium bicarbonate
Pulverized, 120 gm. of each.

Salt leaves a pleasantly clean sensation in the mouth and is a natural tissue stimulant. Sodium bicarbonate is a neutralizer of acid plaques. Precipitated calcium carbonate and precipitated calcium phosphorus are insoluble and abrasive.

I can impress on the patient the idea of so manipulating the brush as to work the powder between the teeth, where most of the plaques are found. Thus, two important points are gained: the removal of plaques and increase of circulation in the gum septum.

To do a thing well, we must be systematic. When teaching methods of brushing, I insist on a definite method of procedure, always beginning in the same location and brushing in a prescribed direction. After I have taught and demonstrated this, I brush the patient's mouth. This is done in order

that he may know, by the sense of touch, when he is brushing correctly. I tell my patients that they will be repaid for exactly the amount of energy that they exert, and the intelligence with which they exert it. In other words, I give a postgraduate course to every patient. I use the Charter principle of brushing.

During the first three years that I treated periodontoclasia, I obtained approximately 40 per cent cooperation for one year or more. The following three years, I received 51 per cent, and the last four years, up to March, 1927, I have received approximately 70 per cent. What has brought about this increased interest on the part of the patient? There are several reasons: 1. The public in general is becoming more educated along the lines of oral hygiene. 2. The first three years, I talked fifteen minutes to my patients regarding mouth cleanliness and told them how to brush their mouths, and the balance of the time I operated, but did no more talking. Result: 40 per cent cooperation. 3. During the second three years, I talked about thirty minutes at the beginning of the treatment and brushed the patient's mouth from four to six times during the treatment. Result: 51 per cent cooperation. For the last four years, I have brushed the patient's mouth at each visit, and have talked all the time, drawing word pictures and demonstrating on models and also on my mouth with a brush, trying to leave a visual impression on the patient's memory. Result: 70 per cent cooperation.

We are slowly learning more of the rules of Nature's game, so that our progress is not the result of hit or miss experimentation, or of random theorizing, but of following a systematic, and whenever possible, a logical, procedure.

STIMULATION OF THE GINGIVA*

By PAUL R. STILLMAN, D.D.S., F.A.C.D., F.A.A.P., New York City

IN health service terminology, the word stimulation means the "excitation of an organ or a tissue to increased activity, along the lines of the particular function of that organ, or part." The word function has, by long usage, come to mean that activity which is normal, as opposed to the abnormal, or pathologic. Stimulation of the gingiva, then, should arouse the highest physiologic action of this tissue.

Our first object here should be to determine what the normal functions of the gingival tissues are. The gingival tissue affords a protective covering for the cervical portion of the tooth where it stands above the crest of the alveolar process, and also for the alveolar process itself. Possibly its most important office is to protect the alveolar bone and the pericementum from bacterial invasion. This conclusion is drawn from the fact that it serves no important purpose as a support for the teeth, nor does it contribute in an important degree to the nourishment of the tooth itself, the pericementum or alveolar bone. Another argument in support of the view that its

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principal office is the protection of the alveolar and pericemental structures is the fact that, when infection does gain entrance to this tissue, the alveolar bone and pericementum, but especially the former, are withdrawn by a process of resorption, ahead of the advancing bacteria. In other words, nature makes a constant effort, which is not invariably successful, to interpose some sort of barrier between the invading organisms and the relatively defenseless deeper connective tissues.

It has been stated that the gingiva does not hold an important place in carrying nutriment to the dental and periodontal tissues. This statement should be clarified to this extent, that while the tooth, the pericementum and the investing bone could be nourished without the participation of the gingival blood vessels, these vessels do form an integral part of the circulation of the periodontium. The gingival circulation shares in aberrations of the periodontal circulation, whatever their source; and also the deeper periodontal circulation can be influenced by changes which take place in the gingival circulation.

As an instance of the possibility of producing such deep influences through the agency of changes induced in the gingival circulation, let me cite a case in my practice.

A young lady, riding horseback, was thrown and, in the fall, fractured one of the upper central incisors. She was referred to a specialist in porcelain work, who made a porcelain crown for the fractured tooth. All the remaining teeth in the mouth became slightly darkened because of traumatism, and were lusterless, owing to disturbance to the circulation incident to the accident. The jacket crown was cleverly shaded to match the uninjured teeth, the immediate final result being very satisfactory from the esthetic standpoint. The patient was then referred to me for treatment of a mild gingivitis and an untidiness of the mouth which developed coincidentally with the occurrence of the accident. Routine treatment was instituted, which included vigorous stimulation of the gingival circulation with the toothbrush. After the second treatment, it was noticed that the new porcelain jacket crown appeared to be getting darker by contrast, and soon it was noticeably different in shade from the other anterior teeth. What actually happened was that the other teeth became more translucent as the circulation improved, and, in fact, took on a totally different complexion, becoming lighter in shade and much improved in luster. So striking was the change that the porcelain jacket had to be removed, and a new one, of a more healthy coloration, was constructed.

It is a curious thing how readily and how rapidly the teeth change color under the influence of stimulated changes in the gingival circulation. A mild case of jaundice will furnish striking illustration of this fact. This is particularly noticeable when there is porcelain in the mouth to serve as a basis of comparison. The dental profession has for many years endeavored to prevent and to treat periodontal disease by removing bacteria from the environs of the periodontal tissues. One thinks in this connection of the old story of the woman who endeavored to sweep back the tide with a broom. Bacteria have never been successfully swept away and kept away from the gingival tissues, nor will they ever be removed permanently from the mouth by this or any other means. A healthy mouth is not sterile. The significance of this situation is that the prevention of infection, or the treatment of infection, must come from an inner defense and not by external prohibition. The gingival circulation must be adequate and active in order that it may possess that tonus essential to its health and immunity.

The problem of prevention and of treatment, then, is, "How may we most effectively raise resistance?" Resistance

to infection resides chiefly in the various elements of the tissue cells and in the character of the blood. It is probable that the tissue cells have certain resisting powers of their own. To raise resistance, we shall naturally endeavor to improve the character of the blood supply to the part, which coincidentally augments the vitality of the tissue cells.

In other parts of the body, we produce such effects by exercise. The term applied to the result of this exercise is stimulation. Exercise is usually understood to imply muscular effort, and tissues in various parts of the body are directly stimulated, if they are immediately contiguous to muscles. When we consider the gingivae, we find that they contain no muscles, nor are they situated near enough to the muscles of mastication to be directly influenced by that function. Under normal conditions, such as prevailed in the mouth of primitive man, the gingivae received their exercise through compression by the coarse, tough food eaten. This may be regarded as passive exercise, but it is effective, nevertheless. Modern dietary habits fail to provide even this type of exercise; with the result that tissue tone and resistance in the gingivae of modern man are usually and almost universally below par.

The obvious answer to this situation is that we must provide, through artificial means, an effect on the gingivae which shall be physiologically identical with those effects provided by the dietary of primitive man. This cannot be produced by exercising the teeth alone through the mastication of food; for this does not of itself produce adequate compression of the gingival tissues. A number of methods have been suggested for producing tonus of the gingival tissue, but, in my experience, this can be secured most simply and effectively by the correct use of a properly designed toothbrush.

The expulsion, by compression of the gingival tissue, of the blood contained not only provides a sort of exercise which has a direct effect on the resisting powers of the tissue cells, but also influences most favorably the circulation in this tissue. Here, again, the local effect is to confer a heightened immunity to infection. This is amply demonstrated by the ease and rapidity with which infections of the gingivae can be reduced and even eliminated through vascular stimulation provided by correct use of the toothbrush.

But the effect of stimulation of the gingival blood vessels, which is essentially a massage, is not confined to the gingival tissue alone. Reference has already been made to the effect on the coloration of the teeth themselves, by influencing the circulation in this manner. This effect goes even deeper and farther; for teeth which have been loose and have suffered from extensive destruction of the supporting tissues become firmer under the influence of correctly instituted gingival massage, than by any other method of treatment with which I am familiar. Healing impulses are induced. The obvious inference is that stimulation of the gingivae is far-reaching in its influence.

The gingiva is the indicator of oral health. By its coloration and form, we can determine every gradation in the health of all the oral tissues. Skillen has recently stated that in order to comprehend the pathology of a structure, one must have a clear comprehension of how that structure appears when it is wholly free from pathologic manifestations; in other words, to understand disease, one should first know health. People with healthy mouths seldom seek a dentist; therefore, the dentist who

would achieve this knowledge must seek for the healthy mouth and study its characteristics. Until recent years, it had never been my privilege to see two mouths in sequence which exhibited entirely healthy gingivae. Dentists are so accustomed to seeing mouths in various stages of disease that they unconsciously accept as healthy those which are the least diseased. They regard as normal conditions those which should obviously be classed as incipient stages of periodontal disease. It may be urged that since opportunities for observing healthy mouths are rare, the average dentist cannot be expected to know what healthy gingival tissue looks like. But this is no longer a good alibi; for he can himself produce this high state of health in the mouths of his patients through the adoption of the methods herein named, and he will then have a basis for comparison.

The signs of encroaching periodontal disease may be classed under two headings: (1) those which possess a departure from the ideal as regards form, and (2) those changes which influence the color of the tissues. By form, we indicate those characteristics which have to do with the shape, or conformation, of the various parts of the gingivae. Color is almost entirely dependent on vascular conditions, i. e., circulation. It includes not only shade, but also translucency of both gingiva and teeth. This latter quality may be illustrated, somewhat crudely, by calling attention to the difference in appearance between a piece of silk and a piece of cotton, both having the same color shade. No experienced person will have difficulty in differentiating these fabrics, no matter how nearly identical in shade they may be.

Form and color are the determining factors in the diagnosis of all periodontal disease, whether incipient or advanced. We must become familiar with every gradation of these factors. Only then shall we know when we have carried the succession of changes, so readily induced in the gingival tissues, back to a point which is characteristic of perfect health.

It is not my purpose in this paper to deal with technic. I have referred briefly to the toothbrush; but I do not particularly care whether this or some other implement or apparatus is used to produce the desired effect. It has been my personal experience that the toothbrush can produce more effective stimulation and a higher state of health than any other agency which I have used. But the thought that I wish to leave with you concerns the beneficient effect of gingival stimulation, not only on the entire periodontium but on the teeth as well. To my mind, this is the important message of dentistry today. It should be preached to the entire population that the means of promoting oral health and preventing oral disease lie in the phrase "adequate blood circulation and functional occlusion of the teeth."

CONSTITUTIONAL FACTORS IN PERIODONTITIS*

By CARL V. WELLER, M. S., M. D., Ann Arbor, Mich.

THE zealous search for "focal infections" has so gripped the attention of both the dental and the medical profession during the past two decades that there has been an altogether too one-sided consideration of the relationship between the peridental infections and the body as a whole. Such infections have been investigated clinically, experimentally and statistically, but only from their centrifugal aspect. It is the purpose of this discussion to invite attention to certain centripetal aspects of the question and to present peridental infections as results, in part, at least, of constitutional factors in the bodily economy. It will thus be seen that the rôle of such infection is by no means a causal one alone.

Disease seldom, if ever, has a single cause. This multiplicity of etiologic factors is less clearly evident when disease is the result of a single mechanical trauma, but even then the varying factors conditioning the receipt of the trauma and the varying reactions to it reveal how complex the biologic substratum really is.

With infections, the multiplicity of causal factors at once becomes obvious. To illustrate: Every adult has had encounters with the tubercle bacillus. Carefully conducted necropsies reveal evidences of tuberculosis in practically every postadolescent cadaver. Yet only about one person out of ten or one out of eight dies of tuberculosis. Only when other factors are present, such as lowered resistance from concomitant infections, malnutrition and fatigue, in the extrinsic group; and a pathologic constitution known to be especially susceptible, from the intrinsic side, are the defensive mechanisms of the body overwhelmed. That which is true of tuberculosis is true also, in varying measure, of all other infectious diseases. One must seek out not only the causal organism, but also the underlying substratum of predisposition, if infection is to be understood.

Similarly, we know now that neoplasms arise only when there is present an intrinsic predisposition to their development. Arsenic-containing paste, dropped accidentally on the mucosa of the tongue and allowed to lie there for a short time, causes necrosis followed by an ulcer notoriously slow to heal. In most individuals, healing eventually takes place. If the patient has an intrinsic predisposition to neoplasia, a squamous-cell carcinoma may develop at the border of that ulcer. I know of such an instance in a young woman only 29 years old, who died from metastatic carcinoma of the cervical lymph nodes, although amputation of the tongue was

*From the Department of Pathology, University of Michigan.

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performed as soon as the nature of her lesion was recognized.

These few examples will serve to illustrate what is meant by the multiplicity of the causal factors in disease. As has already been indicated, such factors determining predisposition belong to two main groups. One of these includes all of the acquired, extrinsic and therefore, in the usual sense, noninheritable elements which increase susceptibility, or decrease resistance, to disease. Here are found those factors which will first come into the mind of each reader when "constitutional factors" are suggested. This concept is rather crudely expressed by the phrase "constitutional pathology" in contrast to the second group, which may be more aptly designated as "pathologic constitution." Here, we are concerned with intrinsic, inheritable factors which largely determine the physical habitus, emotional response and disease predispositions of the body. Within recent years, the importance of the constitutional type in the etiology of disease is being appreciated as never before. The work of Julius Bauer in Vienna and of George Draper in this country has shown clearly that we already are in an era in which both medicine and dentistry must give full cognizance to the intrinsic constitutional background, if disease is to be understood.

Constitutional factors of the extrinsic group can be considered here only briefly in their relationship to periodontitis. Space will not permit even a complete listing of the possibilities, a full discussion of which assumes almost encyclopedic proportions.[1]

1. Misch, J.: Lehrbuch der Grenzgebiete der Medizen und Zahnheilkunde, Leipsic: F. C. W. Vogel, 1923.

Even physiologic processes may serve as predisposing factors. As examples, we have the peridental inflammations frequently associated with menstruation and child-bearing, so-called gingivitis periodica, gingivitis dysmenorrheica and gingivitis gravidarum diffusa. The need for special attention to the teeth during pregnancy is appreciated by all.

The important rôle played by the dietary deficiency diseases is considered elsewhere in this symposium. So great is its importance that it fully merits treatment as a special topic.

Diabetes mellitus is well known to produce a general lessened resistance to pyogenic infection. The physician keeps this in mind and is forewarned of the possibility of gangrene of the extremities and of the intractability of all purulent inflammations. The dentist must do likewise. He must recognize the dry mouth, characteristic stomatitis, chronic gingivitis, periodontitis marginalis and paradental abscesses. His knowledge fortifies him whether the case has been diagnosed as diabetes or not. If it comes to him already diagnosed, he will know that unusual diligence must be exercised to overcome existing infections and to prevent their further development. If the case is not yet diagnosed, how great is the service which the dentist can render his patient if he suspects the true nature of the affection and directs him to his physician for urinalysis and blood sugar determination!

Nephritis, likewise, must not be forgotten. Certain of the middle-aged and presenile patients who come to their dentists complaining of "sore mouth" and that "my plate hurts so I cannot wear it," and who show on examination a dry mouth with pale red mucosa, swollen bleeding gums, perhaps some exposure of roots and varying degrees of

purulent periodontitis, owe their conditions to primary renal disease or to secondary renal changes which are the result of arteriosclerosis. The overenthusiastic advocate of "focal infection" as a cause of nephritis sees the infection of the mouth solely as the cause of the nephritis. I believe that exactly the opposite is the truth in many cases. The periodontitis frequently owes its origin to the general constitutional condition. There are many clinically demonstrated cases of nephritis in which the mouth infections make their first appearance after the renal lesion is obvious. The thoughtful dentist may do such patients a service of inestimable value if they chance to come to him first, for he can secure diagnosis and treatment of the underlying nephropathy. That the peridental infection may be a result and not a cause should always be considered before a wholesale extraction is advised.

If space permitted, the anemias, both primary and secondary, and leukemia should receive full emphasis. The secondary anemia, unsuspected, of oozing hemorrhoids, of gastric ulcer, of a sloughing fibroid of the uterus or of a hidden malignancy may be back of the peridental infection which first brings the patient to the dentist. When the primary anemia is improved by liver diet or the secondary anemia corrected by removing its cause, the mouth condition clears up. The same relationship may exist in sepsis. A patient who had been showing a typical picket fence fever curve with daily chills for weeks had as her only discoverable lesion a severe degree of diffuse purulent periodontitis. Some of her attendants believed that therein lay the cause of the sepsis. No other explanation was available until her right leg drew up through psoas spasm and at operation she was found to have a chronic purulent appendicitis with a small abscess beneath the psoas sheath. With drainage of this area of infection, the mouth condition subsided. So-called "focal infection" outside the oral cavity may be of prime importance in lowering resistance and thus in making peridental infections possible.

Further illustrations of the effect of acquired constitutional conditions cannot be added here, but attention is invited next to an even more interesting aspect of the question—the possible rôle of intrinsic constitutional disease in the etiology of periodontitis.

From the Hippocratists, there has survived the knowledge that a bodily habitus of a particular type is especially prone to tuberculosis, and that once the infection is acquired by an individual of this type, the prognosis is especially grave. One need only visit a tuberculosis unit caring for the more advanced cases or observe the cadavers with serious pulmonary lesions in the necropsy ampitheater to appreciate the great significance of the "phthisical habitus" in the prognosis of this disease. Hippocrates knew also that the individual with a squarish, well-haired chest and with a short ensiform heavily covered with flesh offers just as good a prognosis in phthisis as does the contrasting type a bad one.

In recent years, this aspect of pathology has received concentrated attention. We now know that a large proportion of all human beings can be classified into groups or types upon the basis of their anthropometric characteristics and that each of these different type forms has its own definite implications in respect to predisposition to disease. If we are not predestined beyond hope of escape to be afflicted with certain ills, we are at least predestined to

a special susceptibility or predisposition to certain diseases. Once such diseases are acquired, the predisposed individual may further reveal the effect of his constitutional type by being less able to resist. Knowledge of the pathologic constitutional types is finding application in all branches of medicine. The psychiatrist knows that the broad-faced, wide intercostal-angled pyknotic will, if he develops insanity of intrinsic type, show the manic-depressive type. The long, narrow angled asthenic under similar conditions will fall into the dementia praecox group. For years, we have spoken rather confidently of the thymicolymphatic constitution and of the asthenic, exudative, arthritic, neuropathic and degenerative constitutions and have understood certain of the disease implications of each. We have come to recognize the obvious differences between *Typus respiratorius, Typus digestivus, Typus muscularis* and *Typus cerebralis*[2] of the human animal. Recognition of the Graves' constitution (Warthin) has cleared up many of the problems in connection with exophthalmic goiter. The constitutional types correlated with such varied conditions as ulcer of the stomach, gallbladder disease, nephritis and hypertension, pernicious anemia, tuberculosis, asthma and acromegaly[3] have received intensive study. Pathologic types related to imbalance of the endocrine glands are also recognized and grouped under such terms as hypothyreotic constitution, thyreotic constitution, hypoparathyreotic constitution, hyperpituitary constitution, hypogenital constitution, hypopituitary constitution, hypergenital constitution and hypochromaffinic constitution.

With this wide application of the study of pathologic constitutions to medicine, it must be realized that the same observations have important application to dentistry. Important advances in this field can be safely predicted for the next few years.

There is abundant evidence that the development of the teeth is intimately linked with that of other structures of the body. This, as is easily understood from embryonic considerations, is true especially of the other structures of ectodermal origin, the integument, hair and nails. Of great interest in this connection is the irregularity in size, and numerical reduction, of the teeth in the various races of hairless dogs (Mexican, Japanese and Chinese).[4] In human inheritance, there are many illustrations of this joint involvement of the teeth and skin in an intrinsic pathologic constitution. Congenital hypertrichosis lanuginosa is frequently associated with reduction in number of teeth or even in complete lack of teeth[5] as is frequently seen in the hairy-faced men of the museums. In epidermolysis bullosa hereditaria, there is an enamel hypoplasia,[6] so that whatever the constitutional factor may be that leads to vesicle formation in the skin and mucous membrane, it affects likewise the ameloblasts derived from the same germinal layer. The concomitance of these conditions points to an hereditary fault in the ectoderm. The same family trees which are characterized by monilethrix frequently show also hypoplasia of the enamel or irregular enamel formation. Individuals

2. Bauer, Julius: Vorlesungen über allgemeine Konstitutions- und Vererbungslehre, Berlin: Julius Springer, 1921.

3. Draper, G. L.: Human Constitution. A Consideration of Its Relationship to Disease, Philadelphia: W. B. Saunders Co., 1924.

4. Bauer, Julius: Die Konstitutionelle Disposition zu inneren Krankheiter, Berlin: Julius Springer, 1921, p. 403.

5. Misch, J. (l. c.): Vol. 2, p. 5.

6. Footnote 5, p. 53.

with congenital lack of sweat glands[7] exhibit likewise dental anomalies consisting of reduction in the number of teeth or complete absence of teeth, or an atypical configuration of such teeth as may be present. If incisor teeth are present, the crowns take the form of so-called "peg-teeth" while the roots develop along approximately normal lines. Virchow was aware of the wedge shape and pointed crown of the teeth of those born without sweat glands.

Draper[8] characterizes the upper jaw of the physical type which is prone to gallbladder disease as follows:

> The typical upper jaw of the gallbladder race has a shallow palate, a square anterior arch, and it is set with small sized teeth. The occlusal surfaces of these teeth are almost always in a straight line and the incisors show signs of a marked wear as well as a very definite tendency to vertical or lingual version. The typical upper jaw of ulcer people has a deeper palate, a rounding narrower anterior arch, and is set with teeth of irregular size. The occlusal surface of the teeth is practically always in a waving line and the central incisors always are larger than the lateral. The incisors also show a labial version continuous with the slope of the palate and a sharp cutting edge. The typical jaw of the nephritis and hypertension person is narrower than that of the ulcer person and has a much more pointed or angulated arch.

One of the most fundamental groupings of human beings from the morphologic standpoint is into those of the broad-growing type with broad faces as well as broad trunks and wide intercostal angles, and those of the tall-growing type with long heads and faces, long trunks and narrow intercostal angles. There is good reason for believing that the long-faced type is much more likely to have peridental infections than the broad faced type. If this is true, we have here an example of constitutional type influencing the incidence of periodontitis. Such a difference may well rest upon sound anatomic and physiologic explanations. The broad-faced individual has more powerful muscles of mastication. He stimulates and massages his gums by his powerful muscles. He chews better and harder. Coarse food is more acceptable to him. Thus, for simple mechanical reasons, his more powerfully formed jaws and masticatory muscles tend to guard him against peridental infection. The long-faced type has lighter bones with mandibular and maxillary alveolar processes less powerful. Alinement and occlusion are not so nearly perfect and food particles are more apt to accumulate. Especially is the factor of vigorous chewing massage absent.[9]

The thymicolymphatic constitution with its persistent hyperplastic thymus, generalized lymphoid hyperplasia and vascular and suprarenal hypoplasia likewise has a possible rôle in the production of peridental infections. Saul[10] states that the mouth breathing resulting from large adenoids is an important cause of pyorrhea alveolaris. He quotes an observation made nearly twenty years ago by Sir Frank Colyer that "marginal gingivitis limited to the anterior teeth in children is diagnostic of adenoids." Whether the failure of anterior occlusion is due to persistent mouth breathing or to a faulty development of the jaws which itself is a part of the thymicolymphatic constitution, the fact remains that it greatly predisposes to periodontitis.

The exudative, or arthritic, constitution is not in and of itself predisposed to

7. Misch, J. (l. c.): Vol. 1, p. 62.
8. Footnote 3, p. 148.
9. Röse: Arch. f. Rassen u. Gesellschaftbiol., 1905-1906. (Quoted by Bauer.)
10. Saul, A. L.: Pyorrhea Alveolaris in Its Dental Aspects, J. M. A. of S. Africa, 1: 448-451, 1921.

periodontitis. The broad face and well-muscled jaws, as already explained, are advantageous in avoiding such infection. However, this constitution is especially predisposed to nephritis and to diabetes. From these, in turn, predisposition to peridental infection may arise from acquired constitutional susceptibility as noted in the first half of this paper.

The degenerative constitution is frequently stigmatized by anomalies in number, size, form or position of the teeth, by hypoplasia of the enamel and by irregularity in enamel deposit. All of these irregularities predispose the individual belonging to the degenerative constitution to infections about the mouth. His intrinsic disregard for personal cleanliness enhances the risk.

Reference must be made to certain constitutional types with endocrine implications. Particularly is the hypoparathyreotic constitution prone to disturbances in enamel formation and to faulty calcium deposition in general. The hyperpituitary type is shown by the alteration of skeletal structures including the jaws. The hypogenital type shows as a frequently encountered anomaly unusual size of the upper central incisors with smallness or absence of the upper lateral incisors.

CONCLUSION

To be forewarned is to be forearmed. Periodontitis is frequently a result of multiple etiologic factors among which pathologic constitutional states may play an important part. If these are acquired, the periodontitis should be recognized as a result and not as a cause. Many needless extractions are performed through failure to recognize this relationship. The dentist should be in position to warn his patients of the possible presence of systemic disease conditions which have been unsuspected. If the predisposition to periodontitis is due to an intrinsic pathologic constitution, knowledge of the existence and significance of such a state puts the dentist in a superior strategic position. He knows that unusual zeal is necessary if his patient is to escape peridental infection; and, if such an infection is already present, he knows that his prognosis must be extremely guarded in comparison with that which he feels free to offer to a patient not so predisposed.

THE PRINCIPLES OF PREVENTIVE PERIODONTIA*

By ARTHUR H. MERRITT, D.D.S., F.A.C.D., New York City

THE preliminary step in the prevention of periodontal lesions is, according to James, the placing of the exposed surfaces of every tooth in such condition that the patient, having been carefully taught how to do so, can keep them clean and free from all forms of irritation. There is no correction of diet, no knowledge that may be gained regarding systemic complications, that will make it possible to ignore these local conditions which interfere with the maintenance of correct hygiene. Until such conditions have been established,

*Correlation of the papers of Drs. James, Bricker, Stillman and Weller, read before the American Academy of Periodontology, Detroit, Mich., Oct. 20, 1927.

one is not justified in assuming that there are extra-oral complications. The importance of employing more nearly uniform methods, by the adoption of a definite technic that can be learned by any dentist, is emphasized. James outlines his own technic, using plane instruments with a two point contact on the tooth, and with a push or pull stroke. As the instrument will not "take hold" unless there is something to resist it, the operator will know when a smooth surface has been obtained. This should be followed by careful polishing, which, in Dr. James' opinion, can be successfully done only by hand instruments such as porte polishers and wood points. Strips and tapes have been discarded. Knife edged instruments, files, etc., cut to excess, causing hypersensitiveness. The paper closes with the statement that those who advocate radical measures, such as certain forms of surgical treatment, have not developed a definite technic of root instrumentation or they would not employ such methods.

ORAL PROPHYLAXIS (PROPHYLACTODONTIA)

In his treatment of this subject of oral prophylaxis, Bricker limits himself almost entirely to the education of the patient by the dentist in the principles and technic of mouth hygiene and gingival stimulation. Nothing is said about the technic of oral prophylaxis as practiced by the dentist, it being assumed that such care preceded and formed the foundation for the subsequent instruction of the patient. Such instruction should include definite information regarding the cause and prevention of the more common diseases of the mouth; diet in its relation to such diseases; the importance of personal care in the maintenance of mouth hygiene, and correct toothbrush technic. A detailed outline of the ways and means for accomplishing this is given by Dr. Bricker. He recommends a definite technic in toothbrushing, always beginning in the same location in the mouth, and brushing in a prescribed direction. This is best taught by brushing the patient's mouth and teeth with a stiff brush, as a demonstration, at each visit, employing the Charter method. Dentifrices are used for their abrasive property, the statement being made that they have no therapeutic value. One is recommended consisting of equal parts of precipitated tribasic calcium phosphate, precipitated calcium carbonate, sodium chlorid and sodium bicarbonate.

The statement is made by Bricker that his work in the field of oral prophylaxis is based on the principle that good circulation in the tissues surrounding and supporting the teeth means the health of these tissues, and that the more the gums are stimulated and massaged by the brush, the harder and more resistant they become. Through the inculcation of these principles, Dr. Bricker claims to have received the active cooperation of 70 per cent of his patients in his efforts to create, and maintain, in his practice, a proper degree of oral hygiene.

GINGIVAL STIMULATION

Stillman defines stimulation as meaning "the excitation of an organ or a tissue to increased activity, along the lines of the particular function of that organ or part," which, when applied to the gingivae, "should arouse the highest physiologic action of this tissue." He then proceeds to outline what he conceives to be the normal function of the gingivae, which, as sketched by him, consists in its acting as a protective covering to the cervical portion of the tooth, and to the alveolar process, though its

most important function is possibly that of protecting against bacterial invasion the supporting tissues of the teeth. As proof of this theory, the statement is offered that a constant effort is being made by nature "to interpose some sort of barrier between the invading organisms, and the relatively defenseless deeper connective tissues," as is shown by the resorption of the alveolar process and pericementum when infection gains entrance to these tissues, such absorption being in advance of the invading organisms. The gingivae also hold a place of some importance in the nourishment of the deeper periodontal tissues, as the circulation in these tissues can be influenced by changes which take place in the gingival circulation. A case from practice is cited in which teeth that had been discolored by trauma promptly resumed their normal color after the establishment of correct mouth hygiene, plus gingival stimulation. The attempt to prevent or treat periodontal lesions by the removal of bacteria from the environs of the periodontal tissues is deprecated, since the successful prevention or treatment of any infective process must come from an inner defense and not by external prohibition. This inner defense, known as resistance to infection, resides chiefly in the tissue cells and in the character of the blood. To raise this resistance, it is desirable to improve the circulation in the affected tissues, coincidently increasing the vitality of the tissue cells themselves. In certain parts of the body, this is done by exercise. Under normal conditions, such as prevailed in the mouth of primitive man, the gingivae received their exercise through the mastication of coarse food, in consequence of which they became highly resistant to infection. Since modern dietetic habits do not provide such exercise, the gingivae of present-day man are said to be almost universally below par as regards their resistance to bacterial invasion. It becomes necessary, therefore, in the interest of healthy tissues, to provide artificial exercise for the gingivae and supporting tissue, which, in the experience of Dr. Stillman, is most effectively accomplished by the correct use of a properly designed toothbrush. By its use, the expulsion of blood from the gingivae is induced, providing a form of exercise which has a direct effect on the resisting powers of the tissue cells themselves, at the same time influencing most favorably the circulation in these tissues and creating thereby a high degree of immunity to infection. This is not limited to the gingivae themselves. All the tissues of the periodontium share in the impulse toward health.

Dr. Stillman states that when teeth have become loosened through extensive loss of their supporting tissues, gingival stimulation will do more to reestablish them in health than any other method of treatment known to him. The form and color of the gingivae are believed to be the indicators of oral health. They are the determining factors in the diagnosis of all periodontal lesions, and should be studied with greater care. To this end, it is necessary first to observe the gingivae in health, the statement being made that the dentist has become so accustomed to seeing mouths in various stages of disease that he has unconsciously come to accept as healthy those which are least diseased, because he has no basis for comparison. It is stated in conclusion that the purpose of the paper is not to deal with the question of technic but to emphasize that the prevention of oral disease depends on the presence of an adequate blood supply to the tissues of the periodontium,

induced, if need be, by gingival stimulation.

CONSTITUTIONAL FACTORS

The constitutional factors influencing the incidence and progress of periodontal lesions are divided by Dr. Weller into two groups: the intrinsic, and extrinsic; the difference between these types being roughly expressed as the difference between the "pathologic constitution" and "constitutional pathology." He goes on to explain that the importance of the intrinsic pathologic constitution, as a background for the disease history of the individual, is being realized with added force each year; that we are in an era in which, to a very large extent, abnormal life is being interpreted in terms of pathologic constitutional types. Within certain limits, all individuals are predestined by their intrinsic constitution to certain diseases or disease groups; for example, the thymicolymphatic constitution, especially when combined with the asthenic, predisposes to infection; the degenerative and atavistic constitutional types are prone to malformations of the face and jaws, resulting in increased susceptibility to periodontal inflammation; while the arthritic, or gouty, constitution may increase susceptibility to periodontal diseases, in consequence of the tendency to chronic nephritis and similar conditions which it induces.

The extrinsic disease conditions, by causing disturbance in the correlation and interdependence of organ systems, tend to the development of a "constitutional condition of disease." These cover a wide range, including such conditions as pregnancy and senility, in their influence on the mineral content of the bones and teeth; intoxications, especially by the heavy metals, of which mercury is the most important; deficiency diseases, such as scurvy and rickets; and metabolic diseases, of which chronic nephritis and certain anemias are notorious in predisposing the periodontal tissues to disease. These, and many other conditions, are believed by Dr. Weller to influence more or less seriously the incidence and prognosis of periodontal lesions, and he states that they are of paramount importance in the prevention and treatment of such diseases.

SUMMARY

It may be said that the principles of preventive periodontia consist in the observation of several different but related factors, each of which needs to be seriously considered in any program which has for its object the prevention or treatment of periodontal diseases:

1. Oral hygiene and the elimination from the mouth of all irritating factors of whatever nature.

2. The active, intelligent and persistent cooperation of the patient in maintaining cleanliness of the mouth and teeth.

3. Gingival stimulation, through a more vigorous use of the teeth and jaws, supplemented by systematic stimulation of the gingivae and subjacent tissues, through the proper use of the toothbrush.

4. A wider knowledge, and a more intelligent application of the principles of dietetics, the hope being expressed that, in the near future, the nutritional conditions which underlie and cause the deposition of serumal calculus shall be found.

5. Finally, a broader understanding of the more or less obscure systemic conditions which act as predisposing factors in the etiology of periodontal lesions, and which, in many instances, unfavorably influence prognosis.

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THE IMPORTANCE OF THE RECOGNITION OF CYSTS AND TUMORS OF THE JAWS*

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IT is not without a feeling of considerable temerity that I undertake a discussion of the foregoing subject because of its wide scope and because of the variance in opinion of leading authorities on the subject of benign and malignant growths.

Mills,[1] an English surgeon, presents one of the best definitions for tumors that we have had: "A tumor is a new growth of tissue or cells arising without known cause and continuing to grow on its own account without regard to the growth or nourishment of the individual in which it is forming. It serves no useful purpose and comes to no physiological termination." Keeping in mind, then, this definition, the benign and malignant growths which concerns us in this paper will be distinguished from chronic inflammation and simple hypertrophy. We will consider those pathologic growths which under certain conditions clinically simulate tumors; i.e., those conditions which result in the formation of a localized collection of fluid surrounded by a definite wall or membrane and known as cysts.

In the first instance, chronic inflammation and hypertrophy arise from a known cause and come to a physiologic termination. In the latter group, cysts, there is no new growth of tissue or cells in the masses themselves but there is a growth of cells surrounding them.

A tumor has a distinctive characteristic in that the cells which go to make up the growth possess a life of their own, regardless of the health or nourishment of their host.

It will not be relevant to this paper to consider the etiology of tumors in detail. Little is known as to why these growths occur. Much research has been done, and more is in progress, but up to the present time, there appears to be a seemingly impenetrable stone wall blocking progress in determining the cause.

There seems to be certain predisposing factors which may account for some of these growths. For instance, certain types are common at certain ages: the sarcoma in the young and the carcinoma in the older. Heredity plays some part in the etiology, no doubt, but only as it has its bearing on the development of tissue.

Injury and chronic irritation play their part in the causation of these growths, but more or less indirectly. Neither injury nor chronic irritation will produce any of these benign or malignant growths alone, but coupled with a predisposition to the growths, they may frequently be responsible for them. Just what the nature of all of the predisposing factors is it remains for

*Read before the American Society of Oral Surgeons and Exodontists, Detroit, Mich., Oct., 1927.

1. Mills: Surgery for Dental Students, London: Edward Arnold.

the research worker to ascertain, and it is to be hoped that within the next few years much light will be cast on this great problem, which means so much to humanity.

At the present time, there is a wide diversity of opinion relative to the classification of the benign and malignant growths found in the mouth. Of course, neoplasms in the mouth do not differ materially from those found in other parts of the body. In fact, most of the tumors found in various other parts of the body may also occur in the oral cavity and only differ in their clinical aspect in relation to the difference in the character and amount of trauma and irritation that is present.

Frequently, the location of the growths and the tissues from which they arise is quite an aid in the determination of their character. For this reason, I like the classification of oral tumors as given by Mills[1] and Humphrey's, which is as follows: 1. Tumors arising from the gum. 2. Tumors arising from dental tissues. 3. Tumors arising from bone and periosteum, subdivided into: (a) tumors arising from the alveolar process, and (b) tumors arising from the body of the mandible and maxillae.

Under the first head, those arising from the gum, there occur the papilloma, angioma, epithelioma and sarcoma. Under the second head, those arising from dental tissues, we have the odontoma. Under the third head, tumors arising from bone and periosteum, we have those (a) from the alveolar process, the so-called epulis, and (b) those from the body of the mandible or maxillae: osteoma, chondroma, fibroma, sarcoma and carcinoma.

Some writers classify these growths in relation to their origin and development in soft or hard tissue, while others may base their classification on the type of cells making up the tumor. When there are so many different factors involved, it would seem difficult for any one classification, at the present time and with our present knowledge, to meet all of the requirements. We will now describe briefly the growths that we see all too frequently in the oral cavity.

Under the first heading of our classification, the papilloma is probably the least complex of all of the tumors of the mouth. This is a term loosely employed to include any growth on the skin or mucous membrane based upon or resembling a normal papilla. The papilloma found in the mouth is usually made up of fibrous connective tissue. It arises from the gums, the edges or tip of the tongue, the side of the cheek, and in the azygos uvulae and pillars of the fauces. It grows slowly, and occasions little disturbance until it is large enough to become irritated. It is benign and its complete removal is indicated. When occurring on the cheek, it is easily irritated by the teeth and growth then becomes more rapid.

The angioma, or blood or lymph tumor, arises occasionally from the gum tissue or the side of the cheek. These tumors may be capillary or venous. If untreated, they tend to spread along the surface on which they are situated. Their chief importance lies in the danger of hemorrhage. They should be removed and the larger vessels ligated. Under the second head of the classification as outlined above, or those tumors arising from dental tissues, we find the odontomas.

An odontoma may be defined as a tumor composed of dental tissues which arises from tooth germs. The following varieties of odontoma are of surgical importance: 1. Dental root or simple

cyst. 2. Follicular or dentigerous cyst. 3. Simple odontoma. 4. Composite odontoma. 5. Adamantoma.

The simple cyst sometimes referred to as the radicular cyst is quite a common lesion. It is nearly always associated with pulpless teeth or tooth roots and is frequently found in edentulous jaws long after such a tooth or tooth roots have been extracted. Just how and why these cysts develop has long been questionable and is not at this time clearly established. They probably have their beginning in the so-called granuloma but why some of the granulomas develop into cysts while others do not is obscure. It seems to be a clinical fact that certain of these so-called granulomas increase in size until a large cavity in the bone is formed. The contents of the granuloma becoming fluid in character undergo degeneration. The fluid increases in volume as the cyst develops and the bone immediately surrounding the cyst is gradually resorbed by pressure resorption until a large area is destroyed. These cysts are lined with an epithelial membrane. Just where this epithelial lining comes from is largely speculative. Many investigators believe that it develops from a peridental epithelial remnant.

The rapidity of these growths is influenced in a measure by the character of the surrounding osseous tissue. In the maxillae, the development is more rapid than in the mandible, and on account of the character of these two bones, there is a tendency to greater growth in the maxillae without inconvenience to the patient.

They frequently involve the maxillary sinus in their development and may completely obliterate it. The development of these growths is chronic, slow and without pain.[2] There are usually no signs or symptoms present in the early stages. In the later stages, the cyst may cause pressure on a sensitive nerve and the patient may complain of discomfort. The cyst may develop to such an extent that a change in the facial contour is noticeable. At this time, palpation of the outer walls will convey the sensation of palpating parchment, that is, it gives a crackling sensation.

These growths may become infected either by rupturing or by surgical interference through an error in diagnosis.[3] The surgeon, assuming the cyst to be an abscess, opens it for the purpose of establishing drainage. In such cases, there may be symptoms of infection present and pain may be associated with the cyst. These cysts are filled with a fluid which varies in color and consistency, this depending on the tissues in which it is forming and the length of time that it has been developing. It varies from a light amber to a dark brown. The aspiration of this fluid is very important to a differential diagnosis. One of the best diagnostic factors is roentgen-ray evidence. The plate will reveal a clear cut circumscribed cavity showing definitely the destruction of bone.

In the differential diagnosis, there are two other conditions that must be considered. The first is the acute abscess with edema of the tissues. The distinction between the cyst and the abscess may be made in the length of time in which the edema has been present and the presence or absence of pain. In the acute abscess, we would expect the edematous condition occurring over a period of from twenty-four to forty-eight hours; while, with the cyst, the patient may give a history of swelling

2. Berger, Adolph: Principles and Technic of Oral Surgery, Brooklyn: Dental Items of Interest Publishing Co., 1923.

3. Lyons, C. J.: Cysts and Tumors in the Oral Cavity, J.A.D.A., 11:1098 (Nov.) 1924.

covering a period of several weeks. With the abscess, there would be the history of intense pain; while, with the cyst, development has occurred painlessly.

Second, the sarcoma may clinically simulate the cyst. The development may occur similarly to the cyst, that is, by a slow progressive growth without pain or inconvenience to the patient. The diagnosis may be made by an attempt at aspiration or by roentgen-ray. The roentgenograms of the sarcoma will show an irregular hazy trabeculae of bone, usually of greater density than the surrounding tissue, while the cyst will appear on the plates as a sharply outlined cavity in the bone.

The treatment of the cyst must be surgical. There are two methods by which the cyst may be eliminated. The first employs the Partsch operation of removing the outer wall and suturing the mucoperiosteum to the cystic lining. The objections offered to this operation are that, as little opportunity is offered for bone regeneration, a postoperative deformity remains. The other method consists of opening widely into the cyst, removing the cystic lining in its entirety and packing with gauze every forty-eight hours until regeneration of bone begins to take place. We prefer the latter procedure for the reason that quite extensive osteogenesis will follow and a more nearly normal condition will eventually be reestablished.

The foregoing description, with differential diagnosis and treatment of the simple cyst, applies equally well to the follicular or dentigerous cyst.

The etiology of this type of cyst differs in that these growths develop from the enamel sac which surrounds an unerupted tooth. The sac takes on an hypertrophy and proliferation at about the time the tooth should erupt. These cysts, therefore, occur most frequently between 8 and 20 years of age. Occasionally, they may be found later in life, but they undoubtedly have their incipiency about the normal time of the eruption of the teeth. The teeth which are most commonly responsible for the development of these cysts are the third molars and the cuspids. Usually, there is more obstruction to the eruption of these teeth than the others; which may account, in some measure at least, for this condition.

The next class of these tumors that we shall consider are the simple and the composite odontomas. Moorehead[4] states that in the simple odontomas, only one tooth anlage is involved, and the tumors may be in immediate contact with a fully developed tooth. The composite odontomas are characterized by the presence and fusion of all of the structures which enter into the formation of a tooth; that is, the tumor presents a disorderly conglomeration of cementum, dentin and enamel in varying proportions. Frequently, one or several well-formed teeth may be found in the tumor mass. In other instances, irregular shaped masses of tooth material make up the tumor. These tumors are benign and, after the mass is formed, it is doubtful that the growth continues. They form in youth, and it is my opinion that the development occurs at the same time that the development of the teeth occurs. They may be found in either the maxillae or the mandible. The only symptoms attendant on these tumors is the interference with the normal eruption of the teeth and the development of the jaws. The treatment of these odontomas consists in their complete

4. Moorehead, F. B., and Dewey, Kaethe: Pathology of the Mouth, Philadelphia: W. B. Saunders Company, 1925.

removal. This is accomplished by removing the outer plate of bone and dissecting around the tumor and lifting it out *en masse*. Occasionally, small spurs will push out into the bone, and if these are fractured off in an attempt to remove the tumor, they should be taken out.

The last in this class of tumors is the adamantinoma. Bland Sutton,[5] of London, classifies the adamantinoma as an epithelial odontoma. He believes that these tumors have their origin from persisting portions of the epithelium of enamel organs. Scudder[6] is of a similar opinion. He states that "they arise from the epithelial rests or peridental epithelial débris." He says further that "certain cells of the enamel organ develop erratically, forming later, by their development, the tumor or new growth."

Roentgenographically and clinically, it may be mistaken for a simple or radicular cyst. It seems to be more common in the lower jaw than in the upper. It is the most benign form of epithelial tumor of the jaw. It may be locally malignant, that is, if it is not all removed may return in the same location. It usually appears in young adults between 25 and 40 years of age. Of seven cases in our own clinic within the last four years, all have been at the angle of the mandible and all have occurred in females. Scudder[6] states that they occur about twice as frequently in females as in males. The growth of these tumors is slow and without symptoms unless they become infected, in which case they may become quite painful. The mucous membrane over the tumor is normal unless infected and there is no change in the lymphatic glands. Multiple cysts are usually found within the tumor and the cystic parts of the growth will resemble the simple cyst. The prognosis of these cases is good and no recurrence will follow complete removal. The treatment consists of their complete eradication.

We now come to the third division of the classification as outlined: those tumors arising from bone and periosteum. The most common tumor of the mouth with which the dentist comes in contact is one arising from the alveolar process and periosteum, commonly called an epulis. As its name implies, it is a growth on the gum. These growths are border line tumors and are of slow growth. Bloodgood[7] states that they lie between an area of inflammation on the one hand and a neoplasm on the other. They stand between the really benign, slightly malignant and the malignant connective-tissue tumors.

They are giant-cell tumors, occurring most frequently in children and young adults, and more frequently in the female than in the male. In a series of 167 cases, Scudder[6] reports forty-nine in men and 118 in women. Pregnancy seems to favor the lighting up of these growths and development is more rapid at this time. They have their incipiency in an irritation, in either the periosteum or the peridental membrane. They usually appear as a soft, red irregular mass lying on the gum and are attached to the periosteum or peridental membrane by a single, comparatively slender, stock. They are usually quite vascular and bleed easily. The importance of early treatment of these tumors cannot be overestimated. The cure consists of complete extirpation, followed by the

5. Sutton, J. B.: Tumors, Innocent and Malignant, Ed. 7, 1922.

6. Scudder: Tumors of the Jaws, Philadelphia: W. B. Saunders Company, 1912.

7. Bloodgood, J. C.: American Practice of Surgery, Vol 6.

use of the actual cautery. When these tumors involve the teeth, the latter should be extracted in the operation and the alveolar process should be cut away until the base of the tumor is reached.

The next growth under this classification which will be considered is the osteoma or bony tumor. The occurrence of this tumor in the mandible and maxillae is comparatively rare. It is of very slow growth and its most common sites on the mandible are at the outer angle and in the region of the mental foramen. In the maxillae, it appears in the region of the maxillary sinus and sometimes obliterates that cavity. The majority of these growths with which we have come in contact have been in adults from 18 to 30 years of age. The tumors are very hard and dense and are frequently spoken of as ivory exostosis. They develop without symptoms and are usually not discovered until the patient observes a change in the facial outline. They are benign and, when completely removed, will not return.

Another growth which perhaps occurs with more frequency about the jaws than the osteoma is the fibroma. While this tumor is not common, it is not rare. It may occur in either the mandible or maxillae. Virchow[8] thought that the fibroma originated from the marrow or from the bone itself. Nimmier and Blawel think that it arises from the connective tissue of the periosteum or peridental membrane or from the connective tissue of the blood vessels.

These tumors are made up of hard, dense, fibrous tissue and usually present a smooth surface. They are considered benign and appear most frequently in middle life. They develop slowly and without symptoms until they become so large that they involve a sensory nerve, when they may become painful. As a rule, they give the patient no discomfort and usually they are not presented for treatment until the facial outline becomes distorted. On dissection, there may be seen bundles of granular material in irregular masses constituting a calcification of the fibroma. When these tumors occur on the gum, they are usually classified as epulides. The treatment should consist of their complete removal with the preservation of the bony support. In other words, resection of the bone with the tumor is not indicated.

Other tumors arising from the periosteum may be composed of sarcomatous tissue with large amounts of fibrous, cartilaginous, myxomatous or bony tissue, and are clinically known as mixed tumors. They are the least malignant of the sarcoma group. Their site is in the body of the bone, and they push inward from the periosteum. They have rather definite boundaries, with a smooth surface on which the skin is intact and is normal in color. These growths are slow and without symptoms. The treatment consists in complete extirpation. If the growth recurs after operation, it is often more malignant than it was originally; for, in the recurrence, there is more of the sarcomatous elements and less of the original elements making up this recurrent tumor. Our own experience has been that we have come in contact with more of this type of tumor in the maxillae than in the mandible.

Thus far in this discussion, we have taken into consideration those growths about the jaws that are considered to have the characteristics of being benign or of being the least malignant. We will now turn our attention to those malignant growths about the mouth which

8. Virchow, quoted by Scudder, Footnote 6.

appear in our clinics all too frequently: the sarcoma and the carcinoma.

Pusey,[9] in his treatise on dermatology, describes these growths as follows:

> The sarcoma represents a new growth of embryonic connective tissue. It is prone to form metastasis by way of the blood vessels, resulting in the spread of secondary growths. They are composed of round, spindle, or giant cells with a minimum amount of connective tissue or intercellular substance and a very rich blood supply. There is at times a formation of more or less distinct alveoli, probably due to the fact that the sarcomatous cells grow into spaces of normal connective tissue. The epidermis or mucous membrane over the growth may be normal or the sarcomatous cells may grow into and destroy the epithelium.

Blair points out that the habit of tumors invading neighboring and distant tissues constitutes malignancy. A sarcoma may arise from within the alveoli of the bone from the marrow spaces, in which case it is called a periosteal sarcoma. The rate of growth of the sarcoma depends largely on its location and the form of the predominant cell. The giant-cell and the spindle-cell sarcomas are of slower growth and less malignant than the round-cell sarcoma. The latter is of rapid growth and is very vascular and very malignant.

These growths usually develop without pain, and if of a central or medullary type, they may become far advanced in their development without the patient's knowledge. They may occur at any time in life. The spindle-cell and round-cell tumors rarely occur in childhood, while the giant-cell rarely occurs after 35 years of age.

The prognosis of the round-cell variety of sarcoma is not good unless operation is performed very early. The treatment consists of a radical excision of all the involved tissues well into healthy structures.

A microscopic examination of the tumor should be made in every case after it has been removed to determine its type and the degree of virulence. In every instance, I follow these cases with deep roentgen-ray or radium therapy. The efficiency of this treatment is still problematic, but it seems to be the best that we have at the present time.

These cases should all be checked up periodically for recurrent or secondary growths.

One of the most malignant of the sarcoma group is the melanotic sarcoma. Scudder states of the nineteen cases reported in the literature, only two occurred in the lower jaw. This type of tumor grows rapidly and metastasizes. The lymphatic glands are involved in almost all cases. We have had just one case of melanotic sarcoma in our clinics. This occurred in a baby, aged 10 months. The child was well nourished and had never been sick. When it was 5 months of age, the mother noticed a small black spot above the right incisor tooth, which gradually increased in size until the growth was as large as an English walnut when operated on. The tumor involved the area from the incisor region to the molars. This growth was removed in September, 1923, and deep roentgen-ray therapy was used for several months. At the present time, the baby is well and developing as would any normal child. Following is the pathologic report:

> Tumor of the jaw. The tissue consists of a dark firm mass, size of the end of the thumb, in the center of which lies the bud of a tooth without lime; small fragments of tissue containing spiculae of jaw bone and portions of mucosa of the gums. From the tissues immediately surrounding the tooth bud but not affecting it begins a melanotic sarcoma, composed of fine small spindle cells

9. Pusey, W. A.: Dermatology, Philadelphia: Appleton & Co.

which have left much melanin and some myxomatous degeneration. The sarcoma extends to the periphery of the large mass and invades the bone and tissues of the mucosa of the gums. All portions of the tissues submitted are involved. Diagnosis: melanotic sarcoma.

This type is so malignant that prognosis is bad. Scudder reports that of the nineteen patients, sixteen had died within four months after operation, two could not be found and only one was living. Fortunately, this type of sarcoma appearing in the jaw is quite rare.

The last of the group of malignant growths which we will discuss is the epithelioma or carcinoma. Again quoting from Pusey[9]: "Epithelioma may originate in the rete mucosum, in any of the follicles of the skin, and in the sweat glands or in misplaced embryonic epithelium. In most cases, it probably originates in the rete. Epithelioma occurs in two forms: the basal-cell and the squamous-cell. The basal-cell epithelioma is the superficial or rodent ulcer type. The squamous-cell epithelioma is the lobular or nodular type."

In the basal-cell type, the growth extends superficially rather than deeply. Pusey[9] believes that this characteristic may possibly be due to the fact that the lesion appears typically where the tissues are thin and where the lymphatics tend to pursue a superficial course parallel to the surface.

The squamous-cell type consists of a downward and lateral growth of epithelial cells into the underlying connective tissue. The growth occurs as large finger-like masses or lobules which branch and fuse with adjacent masses to enclose areas of connective tissue. These wild growths may occur on the lips, tongue, palate and cheeks or in the nasal or antral cavities, as well as in other parts of the body. In the mouth, they may be primary or secondary. These lesions in the mouth rarely occur before 35 years of age and invariably appear in unclean mouths. The etiology of these growths is still obscure. One of the factors is some form of irritation to the tissues in which they arise. Another great factor is susceptibility to these growths. Just what constitutes susceptibility is not clear, but there is plenty of evidence that heredity plays an important part. Just what part syphilis plays in epithelioma is another interesting factor. Jonathan Hutchinson states that 40 per cent of carcinomas can be traced to former syphilitic lesions. Whether the syphilitic lesion is a factor *per se* or the irritation which it produces is not clear. In the mouth, we all know that ill-fitting dentures, roughened and broken down tooth roots, sharp edges of teeth, etc., provide an irritation that may encourage the development of these growths. In patients over 35 years of age, the dentist should look on any irritation to the mucous membrane of the mouth with considerable concern, for they may be a source from which carcinomas may easily spring. The successful treatment of these malignant growths of the mouth is dependent entirely on a correct early diagnosis.

The following very complete outline by Scudder will facilitate the diagnosis of tumors of the oral cavity:

The history of the tumor.

Its exact time of appearing.

Its precise location at the time of beginning.

Its size when first detected and its rate of growth.

The jaw involved.

The possibility of trauma.

The condition of the teeth in early and adult life.

Associated conditions of pain, discomfort and deformity.

The presence or absence of cervical adenitis.

The presence or absence of cachexia.

The presence or absence of syphilis and tuberculosis.

The dentists usually sees these mouth tumors before the surgeon does because the average patient does not present himself to the physician until physical discomfort compels him to seek aid. By this time, these malignant growths have usually progressed so far that they are inoperable, or at least the probability of successful treatment is greatly reduced. These cases will not permit of watchful waiting. Any lesion of the mucous membrane or any swelling about the jaws that cannot be accounted for by dental disorders should be looked on by the dentist with grave suspicion. An accurate history of the case and thorough examination of all of the structures involved will go far in the formulating of a sane and judicial diagnosis, without which any advice or treatment will not only be futile but also may aggravate the disease and prove disastrous to the patient.

DISCUSSION

Fred F. Molt, Chicago, Ill.: Dr. Bloodgood advocates the use of the cautery in all cases of adamantinoma, and I was wondering if that were Dr. Lyons' procedure. A few days ago, Dr. Bloodgood stated that he had abandoned the procedure of extracting the teeth in cases of epulis, and that by using the cautery, he is able to control those cases so there is no recurrence. There are in certain cases of so-called condensing osteitis sclerotic bone areas in which it is a little difficult to determine whether there is existing an odontoma, and I should like to ask Dr. Lyons how he differentiates between those cases.

Theodor Blum, New York City: Dr. Lyons' paper was especially of interest to me because he dealt with cysts. In this connection, I would call the attention of those of you who are not familiar with one of the latest theories of the origin of cysts to the work of Erich Becker, formerly of the Berlin Clinic, now dead. It is an excellent monograph. His theory is that cysts form only if there is a devitalized tooth and if there are epithelial rests in the peridental membrane. This would explain a little better than Dr. Lyons' theory of heredity why some cysts are formed from granulomas and why other cysts are not. In other words, it has been shown that granulomas have in themselves the so-called epithelial rests of Malassez, which are the epithelial remainders of the original tooth formation, and there are others in which this is not the case. For the same reason, histologists report to us that the peridental membrane in some cases shows epithelial rests, while in other cases it does not. The immediate cause of the cyst formation, he believes, is a hemorrhage into the peridental membrane. This hemorrhage in the peridental membrane may be caused by chemical action or by bacterial action. And I feel personally that this theory, which is pretty well proved, is one quite satisfactory to us clinicians. I feel very much like adopting it, and I have done so in my own mind. As to the formation or the cause of the cystic fluid formation, it may be of interest to you to know that the following is Becker's theory: After bleeding in the peridental membrane, naturally the blood coagulates and in coagulating, the coagulum itself remains on the outside and the serum on the inside, and in such manner the beginnings of the cyst fluid occur. The further increase in cyst fluid is due to a degeneration of the connective tissue and the blood vessels in the connective tissue, which is strangulated by the continuously growing epithelial cells. The simple cyst, so-called (the best term is radicular cyst), is not malignant, because the epithelial cells of this simple cyst originate from Hertwig's sheath, which is composed of postembryonic cells while the multilocular cyst or the adamantinoma originates from the anlage, which is made up of embyronic cells. This may explain why the multilocular cyst and the adamantinoma are more malignant than the simple cyst. I would not venture to diagnose from a roentgenogram a granuloma or cyst while it is small. I don't think it can be done, and I don't think it can be done in the roentgenogram which Dr. Lyons showed. The cyst membrane is abnormal, of course. I believe that the so-called conservative operation of Partsch is indicated in all large cysts, especially of the upper jaw, and I am surprised that Dr. Lyons does not use it. I have always thought that Dr. Lyons was employing this method

for large cysts. I have done so ever since I operated on cysts and I feel that it is the operation, especially in the upper jaw, and, as I said before, in large cysts. I would like to refer to the malposed teeth in the mandible, and I am wondering whether Dr. Lyons would not consider it good policy to expose these and have orthodontic appliances or some attachment made to accommodate these teeth, and have them slowly pulled out of this position if he believes it is so difficult to remove them.

Arthur E. Smith, Los Angeles, Calif.: Dr. Lyons has covered his subject in a masterful manner. There is only one question I would like to ask, and that is what has been his experience with using xeroform gauze in place of iodoform. Dr. Bloodgood showed me a number of cases treated with it with excellent results and I have seen others. It is a bismuth compound, and it is more tolerable to the patient than is iodoform. I have used it in several cases with excellent results.

E. C. Hume, Louisville, Ky.: The completeness of Dr. Lyons' examination is always to be commended. There is nothing left undone before the operative procedure is instituted and that is one of the things we should all bear in mind. In those so-called simple things about the mouth, we will find a metastasis or other manifestation about the body that will make us hesitate to do things we otherwise would and avoid serious criticism in some instances. The question of aspiration is one I want to mention. In work on larger cysts, it is my practice to aspirate each one. This makes it easier to enucleate the cyst. Dr. Sherrill, who read a paper before our organization in Louisville, brought out, in his new work on surgery, the scientific work that had been done relative to the content of the cyst, and he pointed out that in instances in which we find blood in the fluid we may look for malignancy. He says that all cysts from which you aspirate bloody fluid should be regarded as malignant until proved otherwise. I was glad to know that Dr. Lyons uses the cautery when he has completed operation on these cysts of what some men see fit to term a mild type of malignancy. I am of the opinion that there is nothing that will serve the purpose any better than the actual cautery in those cases, and I am using it regularly. Until some one finds something better, I am going to continue to use it.

Harry M. McFarland, Kansas City Mo.: I should like to ask Dr. Lyons whether he has paid any attention to the diet of the patient in building in these areas where cysts have been removed.

Dr. Lyons (closing): I always use the cautery in adamantinoma. I am surprised that Dr. Bloodgood advocates conservation of teeth in the removal of epulides. I feel that it is not safe to do so. I have seen too many of them return when I was trying to conserve teeth at the expense of a possible malignancy. We had better sacrifice the tooth rather than half the jaw later on. Dr. Molt spoke of some of these cases of condensing osteitis, and odontoma. I think it was Boyd Gardner who classified some of these cases of condensing osteitis as cementoma. When we have a condensing osteitis, perhaps following the extraction of an abscessed tooth, in a few months we find condensed tissue, which, in the roentgenogram, may take on the appearance of osteoma, but in those cases, the roentgenogram will show the distinct outline of a cementoma. The odontoma is made up of all the materials of a tooth, including the enamel. I still feel the same about the Parsch method of operating on cysts except in the maxilla when the antrum is invaded. There, I will compromise and suture the normal mucous membrane to the inner cystic wall. In those cases in which the antrum is invaded, the Parsch method is indicated, but in all the other cysts, when we can remove the membrane and depend on granulation tissue for repair, I think we have fewer postoperative defects than with the Parsch method.

A HISTOLOGIC STUDY OF A TOOTH PECULIARLY IMPAIRED IN FUNCTION

By HORACE E. JONES, D.D.S., Fort Wayne, Ind.

IN the extraction of teeth, it is the experience of all operators that, once in a while, a portion of the external alveolar plate of the maxilla comes away with the tooth, usually a molar. It has been the opinion of some that this occurrence is indicative of faulty technic, but it is beginning to be appreciated that subnormal bone conditions are often present, and with the most skilful technic, small pieces of the external plate will occasionally be fractured with teeth. Cahn[1] has called attention to the pathologic condition responsible in a case of fracture of the tuberosity. Hopewell-Smith[2] and Dewey[3] have shown that, in pyorrhea, the bone is often halisteretic. Neustadt[4] has pointed out that the growth of bone is dependent on function, and will be well developed only as the optimum of normal function is secured. In sectioning an upper left first molar recently to study the small portion of bone adhering to the buccal roots, it seemed desirable to section the entire tooth to study the dentin under the peculiar conditions presented, and it was then noted that not only does impaired function influence the growth of bone, but the entire tooth will also be much affected.

1. Cahn, L. R.: Pathology of the Fractured Tuberosity, Dent. Items Int., 48: 744, (Oct.) 1926.

2. Hopewell-Smith, Arthur: Normal and Pathological Histology of the Mouth, Vol. 2, p. 282.

3. Dewey, K. W.: Tissue Changes and Regenerative Potencies in Paradental Disease, J. A. D. A., 14: 280 (Feb.) 1927.

4. Neustadt, E.: The Growth of Bone as Related to Function, Internat. J. Orthodontia, 13: 555 (July) 1927.

REPORT OF CASE

C. T., a man, aged 25, complained of acute pulpitis in the upper left first molar. Examination showed that the mouth was well cared for for a young man of this age, the teeth being in ordinary—not perfect—occlusion, and noncarious. The lower first molars were crowned and the upper right first molar was missing. The upper left first molar was quite extraordinary in that the entire upper portion of the crown was missing, only a small rim of enamel being present, and the resulting dentin occlusal surface was light brown and quite hard. This tooth presented, in short, the typical attrition of teeth in the inveterate tobacco chewer's mouth, but all the other teeth showed only the most normal wear. This tooth was not in occlusion and so could not receive the stress of mastication as it should. There were no gingival complications.

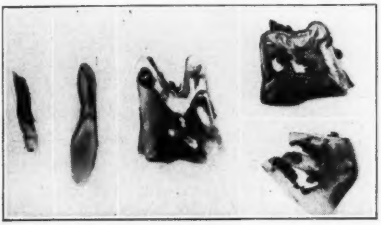
There was no history to indicate why this tooth should lack its occlusal surface. It had always been so, as far as the patient knew. He was positive that it had never been crowned. He had had all the "childhood diseases," such as measles, but none of his teeth showed visible hypoplasia of the enamel. There had been no previous odontalgia.

On this occasion, the patient had had some pain in this tooth for several days. At first, "poloris" pads relieved it, but they became ineffective. As there was no caries, it was difficult to believe that this tooth was the offender. The first treatment consisted in applying a counterirritant to the gum. The next day, the patient reported again with

pain, and, as he insisted on immediate extraction, this was done. During extraction of this tooth, the palatal root fractured and a small piece of the external alveolar plate came away with the tooth. The palatal root was removed.

For microscopic examination, the tooth was cut longitudinally into four parts from the mesial to the distal surface. The buccal portion was again cut into two portions from buccal to lingual surface, and the five sections were prepared by a modified Koch-Weil process, with picrocarmine stain.

Section A, through the periphery of the mesiobuccal root, shows that the bone over



A B C D-E

Slightly enlarged photograph of sections of tooth.

the root was extremely thin, and, at the same time, was irregular in contour on the inner surface. The cementum under the bone was normal, this indicating that periodontitis had not been experienced. The apical third of the root was denuded of bone and, in this portion, the cementum was hyperplastic and rough.

Section B, through the crotch of the buccal roots, showed bone of normal appearance filling the space. It had a generous medullary space, and a wide communicating channel to the periodontal membrane.

Sections C, D and E, through the remainder of the tooth, present quite a diverse assortment of pathologic conditions of the pulp and internal portions of the tooth. In each, the dentin occlusal surface is altered, the dentinal tubulae being completely calcified to a point close to the pulp, which had degenerated. The sections show extensive internal absorption of the dentin.[5] In places, it is replaced by osseous tissue, and in others the absorption is still in progress and the spaces are filled with granulation tissue. In C, the cementum in the crotch between the buccal roots is thickened. This affords an illustration of a point made by Bödecker[6] that the cementum grows in thickness as the tooth advances in age, and thus an attempt is made to keep the tooth in occlusion. In D, a section between the buccal roots on one side and the lingual root on the other, communicating channels containing soft tissue are seen running from the osseous tissue in the pulp chamber to the periodontal membrane. While this is unusual in normal teeth, it seems to be usually observed in cases of extensive internal absorption of the dentin. Above one of these channels, on the surface of the root, external absorption of dentin and cementum is noted, as also is seen at one place in E, a section of the palatal root slightly to the buccal of its center.

From the sections, the utter futility of attempting to save such a tooth is at once apparent. It is, no doubt, true that the present pain came from the osseous tissue's encroaching on the nerves of the pulp. Hopewell-Smith says that internal absorption is due to chronic inflammation of the pulp. It is possible, in the present case, that this was initiated by the loss of protection to the pulp afforded by an occlusal surface of enamel. The ever-present possibility, in extraction, of fracturing the external alveolar plate suggests again that this should always be in the operator's mind, and he should have a sharp lancet at hand to detach the soft tissues, when necessary.

3034½ South Calhoun Street.

5. Footnote 2, p. 64.

6. Bödecker, C. F.: A Consideration of Some of the Changes in the Teeth from Youth to Old Age, Dent. Cosmos, 67: 543, (June) 1925.

ANATOMIC INFLUENCES ON THE ESTABLISHMENT OF BALANCED JAW RELATIONS AND BALANCED OCCLUSIONS*

By WALTER H. WRIGHT, D.D.S., F.A.C.D., Pittsburgh, Pa.

FULL artificial dentures are absolutely different from natural teeth. Natural teeth are integral parts of the patient; dentures are artificial substitutes. Natural teeth are imbedded in bone; dentures adhere to mucosa covered ridges. The loss of teeth is not inherent in the human race. Our sympathy is aroused by the cripple who walks with crutches, yet we forget that edentulous persons also are crippled. Though not so obviously deformed, they may be even more seriously handicapped. They suffer from the effect of improperly masticated food. Their personal appearance is unfavorable. Confidence and poise have forsaken them. Indeed, an edentulous individual is decidedly abnormal. When we realize this fact, we have a true conception of the need of prosthetic dentistry.

The peculiarity in structure and function of each denture patient requires a restoration suitable to the individual need. This idea is quite adverse to a common practice, which recommends the construction of all dentures according to a standard or average formula, without regard to the patient's requirements. When such dentures give trouble, which frequently occurs unless the patient is pertinacious, the patient is classified as abnormal. He is thereafter frequently left to suffer his own misfortune.

It is difficult to imagine two edentulous patients with identical conditions. No two individuals look exactly alike, nor are their jaws similar. These peculiarities result from variation in structure and function. They must be considered in constructing dentures. To provide the longest and most efficient denture service is our purpose. Denture service aims, therefore (1) to conserve the health and prolong the life of patient and the denture supporting tissues; (2) to insure to the patient physical and mental comfort; (3) to obtain the most esthetic appearance; (4) to restore the patient's confidence and poise.

The duration of denture service depends on the permanency of the supporting tissues. The tissues in turn are affected by the dentures which they support. Conservation of the denture supporting tissue is today the outstanding problem in denture construction. Balanced articulation is the solution to this problem. Balanced articulation involves both jaw relation and occlusion of the teeth.

Balanced jaw relation may be defined as that relation existing between upper

*The papers of Drs. Wright, Schlosser, Sears and Paterson make up a symposium on "Balanced Occlusion."

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

and lower jaws when they function or rest in equilibrium. Balanced occlusion refers to simultaneous intimacy of static contact between the opposing masticatory surfaces. Balanced jaw relation together with balanced occlusion, when put into motion, results in balanced articulation.

The necessity for balanced articulation with natural teeth may be an undecided question, since they are firmly retained in bony sockets. Dentures are retained in compliance with physical laws and balance is absolutely necessary to insure their efficient mechanical working and to maintain the physiologic integrity of the supporting tissues. A denture cannot be truly serviceable unless it possesses retention; nor will its retention be effective unless balanced articulation is present. Malarticulation is the outstanding cause of our denture failures.

The prosthetist is confronted in each denture restoration with the anatomic foundation, physiologic function, esthetic requirement and psychic condition of the patient. We must confine this discussion to the anatomic foundation. The patient provides the denture foundation; the prosthetist must construct a restoration which will render the maximum of service with the minimum of tissue destruction. Let us try to establish the interrelation beween balanced jaw relation, balanced occlusion and anatomic structures. This subject may be presented for convenience under three headings: osseous structures, musculature and soft investing tissues.

OSSEOUS STRUCTURES

The size, form and structural details of the osseous foundation present many variations. For this reason, it is imperative that the operator harmonize these variations in a restoration which will permit the most efficient service under prevailing conditions. Ideal conditions are seldom present. Unfavorable conditions are numerous and their restoration requires greater experience and effort.

The toleration shown by anatomic structures is marvelous. This accounts to some extent for the numerous examples of persons who persevere with dentures which do not answer the mechanical requirement of the foundation structures. In due time, the anatomic foundation succumbs. The remains are visible daily in abnormal conditions such as: atrophied (pipe stem) mandibles, "burning" palates, completely resorbed ridges and flabby mucosa, most of which result from malarticulation.

The importance of a sound osseous foundation for denture construction is not fully appreciated except by one who has been engaged in making restorations for patients who have met with accidents. In a former discussion,[1] I have endeavored to show that profound changes in the osseous structures of the jaws may follow malocclusion and loss of the natural teeth. Complete resorption of the alveolar portion of the jaws, widening of the angle of the mandible and abrasion of the articular surface of the condyles are typical end results which confront the prosthetist in his reconstruction work. To be able to recognize these conditions is not enough; we must prevent further damage if possible.

We have a still greater responsibility: that of preventing abnormal conditions, while it is yet possible, by establishing and maintaining balanced articulation. We predict that, in prevention, lies the future hope of prosthetic dentistry, though, at present, it is frequently mis-

1. Wright, W. H.: Some Observations of Jaw Relationship to Be Considered During Full Denture Construction, J. N. D. A., 9: (March) 1922.

understood and rarely practiced. Most denture failures, with their accompanying misery, result from malarticulation, and are, therefore, not due to quality of materials, esthetic appearance or mental attitudes, as has so frequently been proclaimed. Indeed, one feels like exclaiming, "Woe is the prosthetist who does not take into consideration these fundamental requirements."

THE MUSCULATURE

Mandibular movements result from muscle action. When malocclusion of natural teeth is present, the muscles are forced to adapt themselves to abnormal conditions, thus acquiring habits which require correction when dentures are made. When balanced conditions are restored, the muscles may be expected to rearrange themselves gradually so as to function under the new conditions. Changes caused by muscular readaptation may necessitate the reestablishment of balanced jaw relation and subsequently balanced occlusion.

The balance which exists between the jaws is a definite yet delicate relation. The operator cannot trust his vision alone but must also depend on the patient's tactile sense in determining balanced jaw relation or balanced occlusion. It requires both skill and patience to restore between the jaws that exact mechanical balance which is so necessary to maintain physiologic balance in the functioning masticatory mechanism.

Much difficulty has arisen from the application of muscular stress during the establishment of jaw relations. A common practice requires that the patient "bite" upon occlusion rims during this procedure. The principal difficulty with this method lies in the impossibility of either the operator or the patient reproducing the same amount of pressure subsequently. Muscle action during establishment of balanced jaw relation permits the introduction of undesirable variations and frequently results in unbalanced jaw relation.

In order to eliminate these possible discrepancies, centric jaw relation should be established without biting stress. The opposing occlusion rims must make simultaneous intimacy of contact without the application of muscular pressure. For this reason, the patient should never be instructed to "bite" during the establishment of jaw relation. This difficulty is overcome by telling the patient to "close slowly" into the softened wax, and during this time, the operator has an opportunity to observe progress and to discontinue the closing movement at the proper moment. For this purpose, very narrow and well softened wax occlusion rims should be used. With pressure at zero, an unstrained starting point is established which can be reproduced successively, and abnormalities of the musculature are not incorporated into the registration.

Natural teeth are not subject to dislodgment during mastication because they are firmly imbedded in bony sockets. Dentures must be balanced by at least three remote points, surface or area contacts of the opposing teeth to insure retention. Indeed, this triple contact does not of itself guarantee stability to the dentures, for each denture rests upon mucous membrane which also must receive special consideration in order to perfect balanced relations.

SOFT INVESTING TISSUES

Balance in denture restorations is possible by a careful consideration of the denture supporting tissue, especially when it is unusually resilient. Since dentures are not fastened to the jaw

bone, stable equilibrium is rarely present, and then only momentarily, under great muscular effort. Neutral equilibrium is the rule, and thus dentures may move upon their soft supporting tissues without being unbalanced. When the mucosa is of equal density and uniformly distributed over the denture supporting area, its effect is readily controlled. Where great variation occurs, it may be advisable to resort even to surgical removal in order to insure balance in the subsequent restoration. It is advantageous to eliminate as much as possible the influence of yielding mucosa supporting tissue before centric jaw relation is established.

Fig. 1.—Left: Patient with old dentures, with jaws at rest. Right: Patient with old dentures, with teeth in occlusal contact.

This is accomplished during impression taking and base plate construction. By careful manipulation of impression materials, it is possible to eliminate to a great extent the undesirable effect of yielding mucosa. This is brought about by the displacement or relief of the tissue in question as indicated by the individual requirement of the patient.

The beneficial effect of an excellent impression may be lost by a poorly constructed base. Base plates are the foundations of dentures. They must therefore conform as nearly as possible to the requirements of the finished denture base. Wax or composition base plates are commonly used in denture construction prior to vulcanization. The discrepancies involved in changing from temporary bases of this type to the finished dentures are eliminated by using permanent denture bases. Permanent denture bases are made of vulcanite or metal and are used for all steps in full denture construction where bases are required. Subsequently, teeth are added to these bases, and they become part of the finished dentures. In this manner, the unfavorable influence of the variable supporting mucosa is reduced to a minimum and its effect remains constant throughout the entire process of denture construction.

A few moments spent in discussing the effect of unbalanced jaw relation

and occlusion on the anatomic structures will be apropos here. This can be done by selecting a single patient as an example.

Figure 1, left, shows a patient with quite an asymmetrical facial outline. The lower third is displaced to the left side. In Figure 1, right, this condition is even more forcibly illustrated when the dentures are in occlusal contact. This condition was not present eight years ago, when the dentures were constructed. It is possible that the dentures were constructed with the wrong jaw relation and unbalanced occlusion. Since that time this condition has been gradually developing. Heroic persistence enabled this patient to tolerate such an unsatisfactory condition.

Fig. 2.—Unbalanced protruded left lateral occlusion associated with centric jaw relation.

Figure 2 affords a view of the occlusion which was responsible for this abnormal condition. The masticatory surfaces of the teeth provided inclined planes which forced the lower jaw and denture to the left side. Notice that the teeth are in unbalanced protruded left lateral occlusion.

The old dentures were discarded and new ones made. Figures 3 and 4 tell the story of the new restorations. Balanced jaw relations and balanced occlusion were established. The remarkable improvement in esthetics is noticeable in the photographs, but the patient alone is able to estimate the improvement in comfort and efficiency.

Fig. 3.—Front view, showing new restoration.

CONCLUSIONS

1. The individual requirements of each patient must receive consideration during denture construction.
2. Balanced relations must be established between the jaws regardless of the peculiarities present.
3. Muscular pressure should not be used in establishing centric jaw relation.
4. The unfavorable influence resulting from the presence of soft supporting tissues under dentures must be eliminated to insure balanced relations and occlusions.

5. Balanced articulation is absolutely necessary for efficient denture service.
6. Unbalanced relations and occlusions may have a profound effect on the anatomic, physiologic, esthetic and mental condition of the patient.

DISCUSSION

Dayton Dunbar Campbell, Kansas City, Mo.: After eight or ten years of experience with various articulators, I am ready to subscribe to all that Dr. Wright has said about adjustable instruments. I might say, incidentally, for the benefit of many of you who have not had an opportunity to attend the National Society of Denture Prothetists, that every other member of the organization is, I believe, of the same opinion; that articulators must now be constructed so that they may be adjusted to conform to the individual requirements of the patient. Artificial dentures are a luxury and not essential to health in this age of food choppers and colanders. Malarticulation or malocclusion, as Dr. Wright has told you, is the chief cause of our troubles. How are we to get away from constructing dentures with this malocclusion? In the past year, I have had any number of dentists ask me what particular kind of an articulator I would recommend, and I would ask in each instance if they knew how to secure an accurate central occlusal relation of the jaws. As many methods were described as there were men talking to me. Dr. Wright spoke about accidents in securing this jaw relation, but he said nothing about how we are going to be sure that they close in this most habitually retruded position, with the head of the condyle in the glenoid fossa. If the jaw is closed in a protrusive relation the starting point for the construction of the dentures is going to be false. In obtaining any one of the jaw relations, lateral, protrusive or this habitually retruded position, one must have a guide, and we have it in the simple little instrument known as the incisal path marker put out by the Dentists' Supply Company, and given to the profession fifteen years ago by Dr. Gysi. It is possible with this incisal path marker for the patient to scribe the arc of two circles. When the path marker is in the apex of the two arcs, we know that we have the correct central occlusal relation. When we are to obtain the lateral condyle paths, it is absolutely essential that we have no one of the protrusive components or elements of protrusion in this lateral path, and this incisal path marker, in turn, tells us whether we have any portion of the protrusive element in our tracing. As Dr. Wright said, we cannot build our house upon the sand. We can put this fundamental to good use in our own work; for instance, we should have no hesitancy at all in removing that portion of pendulous tissue that wafts back and forth in the breeze so we may have a permanent base on which to rest our denture. It is one of the more simple surgical operations. I do not care for vulcanite bases. Bases can be constructed of other materials that are more satisfactory. My experience with metal bases convinces me that they are far superior to vulcanite. Occlusion models or bite rims, as some choose to call them, should be made up in every instance in the best manner that the material you are working with will allow. There are many reasons why; for instance, better adaptation to the tissues, so that they will be smooth and not irritate. One could read a very satisfactory paper on the construction of occlusion models.

Fig. 4.—Profile view, showing new restoration.

E. B. Owen, St. Louis, Mo.: Dr. Wright stated that all human beings are not alike,

neither are their jaws similar. One of the great difficulties that we have in denture construction, or one of the things that have retarded progress in denture construction, is the fact that the human jaws are similar but not identical, and if we will appreciate the fact that there is a similarity without identity, we can appreciate the necessity of establishing individual conditions in building a denture.

Dr. Wright (closing): Dr. Campbell stressed several points which are interesting. I admit that vulcanite is not the ideal material for denture bases. We need something better, but, at the present time, the many substitutes are not very promising. I hope that the time will come when a perfect substitute will entirely replace rubber. Dr. Campbell mentioned the fact that I did not suggest a method for securing centric jaw relation. This paper does not attempt to discuss technic. It is the dentists' duty to inform the public that dentures are absolutely necessary to the maintenance of health and happiness. I feel that self confidence and poise are two important qualities which an individual cannot possess if he does without dentures when he needs them. If man lived alone, it might be different. Take one example, speech. Speech is so distorted when the teeth are lost that the edentulous individual is seriously handicapped in our modern business life. In fact, business concerns in our city insist that those who apply for positions must have teeth before they will be accepted. Since our business concerns are exacting in this respect, I think that we should be no less firm in insisting on all edentulous persons wearing artificial dentures. They are absolutely necessary to the maintenance and enjoyment of sound health.

THE RELATION OF PHYSICS AND PHYSIOLOGY TO BALANCED OCCLUSIONS*

By R. O. SCHLOSSER, D. D. S., Chicago, Ill.

THE relation of physics and physiology to balanced occlusion is very comprehensive. Each of these subjects has received attention, from time to time. I doubt that the profession at large fully realizes the close relationship of these considerations. The theme can hardly be dealt with justly in the limited time allotted to the presentation of this paper.

Physics is thus defined in Webster: " . . . Now physics is usually held to comprise the closely related sciences of mechanics, heat, electricity, light and sound, and to deal only with those phenomena of inanimate matter involving no changes in chemical composition. Motion is the most general and fundamental of all such phenomena, and physics is sometimes defined as the science of matter and motion."

About physiology, the same authority says: " . . . The branch of biology dealing with the processes, activities and phenomena incidental to and characteristic of life or of living organisms; the study of functions of the organs and parts during life, as distinct from anatomy, which deals with their structure. These processes and phenomena include many that are chemical, physical and mechanical, as well as others apparently of a peculiar nature; those which are purely mental are, however, not included in the ordinary scope of physiology."

Physics and physiology are the sciences which we must understand in order to achieve balanced occlusion; for balanced

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

occlusion is but the result of their wise application. Of all branches of physics, mechanics is the most important entering our problem, and it should go without saying that geometry, cinematics and statics are involved *per se*.

Balanced occlusion has been variously defined *in toto* and *in parte*. We will content ourselves in considering balanced occlusion as a series of occlusions of the opposing masticatory surfaces in conformity with accepted conceptions, deducted from our understanding and interpretation of anatomic forms and function and physiologic requirements.

We shall not attempt to define a particular conception of balanced occlusion but assume that we know what is meant by a typical contact relation of the teeth, designated as balanced occlusion.

We are agreed that physical phenomena, be they due to form, force or function, have an influence on physiologic conditions, and these very conditions again react on the physical. Thus, we have a reciprocal influence which may turn a status to better or worse. At this point of reasoning, we should give consideration to balanced occlusion, which implies form and alinement of masticatory elements, permitting effective masticatory and speech function in compliance with our present conception of a condition best tolerated by the tissues.

It seems to have become a matter of course to the present-day city dentist, and many country dentists, to send full and partial denture work, involving rubber, porcelain and metal work, to the dental laboratory. The laboratory technician receives his contract through messenger or mail, and he is expected to return his work via the same route. The laboratory man usually does his work well. We have to remember that his function is analogous to that of the superintendent of a suit and cloak factory supplying a ready made suit establishment; with the difference in effect that a near-fit suit may more readily be altered to fit after a fashion and will be less dangerous to the health of the wearer than a denture restoration not a perfect fit, which is always an affliction. The entire method of handling denture restoration work as described is not the laboratory technician's fault. Ignorance and lack of application on the part of the dentist has to bear all responsibility.

Professional practice requires one to know why, when, where and how certain operations are to be performed. A dental practitioner must also be able to do it himself. That is quite different from the requirements of a professional engineer, the man we conceive in terms of mechanics only. He is not expected to execute by hand and instruments his own ideas. In fact, physical conditions usually eliminate him as a mechanician.

In the face of such a state of affairs, one should not wonder that teachers spend considerable time in training the dental students in setting up teeth. I, for one, endeavor to develop mechanical aptitude in my students, though, I must confess, I frequently fail to make them realize that the mechanics of setting up teeth and finishing restorations are but phases of denture construction, and not all. You, my confrères, will consider it time wisely applied, if you will familiarize yourself with every detail of denture restoration at the chair and in the laboratory. Only then will you be able to give sensible orders to, and supervise your dental and your technical assistants, and, last but not least, you will fathom the depth of the relation of physics and physiology to balanced occlusion.

The setting up of teeth in wax is purely mechanical work: so is the modification

of the masticatory surfaces of artificial and of natural teeth. Bonwill's opinion on this subject, published in 1884-1885, reads: "After thirty years of active life in dentistry, I am fully persuaded that of all that constitutes dentistry proper, the mechanical forms the basis." And a similar expression by J. Kendall Burgess before the Section on Periodontia at the Seventh International Dental Congress is this: "If we are going to practice the profession of dentistry, and whether we desire to be considered surgeons, artists, or what not, we must above all be mechanics. There is no disparagement here; the tragedy lies in the fact that so many of us, whatever else we may be, or desire to be called, are not mechanics." Many others have spoken similarly. I may say, it holds good today.

It is well-nigh impossible to discuss occlusion and articulation without reference to steps preceding and involving tooth alinement; namely, diagnosis; impressions; making of casts, etc., and temporary or permanent base-plates; recording of positional relations; transferring of the occluding contour models to the occluding frame or articulator; selection of suitable teeth for the case and the working out of acceptable intermaxillary space; contour restoration; the allocation of the median line, and so on. I have but mentioned these indispensable factors here.

If the opinions of Bonwill, Burgess and others are correct—and I am convinced they are—we must pursue a course quite frequently brought to our attention; namely, we will have to see to it that all branches of dental knowledge become more intimately correlated than they are at present, and that mechanics, which is part of physics, be given emphasis. The reciprocal relation of the independent sciences physics and physiology becomes evident to us by the irritation and disease of the tissues.

We find abundant good literature in our libraries on physiology and physics. During the last few years, we have added the study of a few chapters on dental engineering by Hanau. I call your attention especially to Hanau's laws of articulation. They formulate the physical considerations pertaining to the setting up of teeth in balanced occlusion. Dr. French, of Ottawa, Canada, will acquaint you more thoroughly with them, and Victor H. Sears, of New York, will introduce to you a modification of masticatory surfaces of the posterior teeth. Drs. French and Sears will give typical applications of mechanics to dentistry.

CHANNEL TYPE POSTERIOR TOOTH FORMS*

BY VICTOR H. SEARS, D.D.S., New York City

A SURVEY of the vast array of posterior tooth forms offered to the dental profession leaves little room for doubt that, in the mind of the tooth carver, nature's forms have been the guiding influence. In view of the fact that prosthetic dentures must function under artificial conditions, it should not be surprising that artificial tooth forms may possess desirable features not found in natural tooth forms. The very features that make natural forms suitable under natural conditions may easily, under artificial conditions, be detrimental.

Let us inquire into the conditions under which prosthetic dentures function in the mouth. If we are to intelligently design teeth to direct and to resist the masticating forces, it is essential that we know something of the magnitude, direction and points of application of the forces to which the denture will be subjected.

Considered in its entirety, the typical mandibular alveolar ridge is an elongated semicircular hard mound overlaid by a thin layer of soft tissue. In the posterior molar region, the ridge turns upward and is more thickly overlaid. First, consider the form and character of the mandibular alveolar ridge with special reference to its stabilizing effect on the mandibular denture when forces are exerted from various directions. We select the mandibular denture for our investigation because it is usually less stable and because it is supported only by the ridge.[1] Thus, the problem is somewhat simplified.

Our aim is to minimize the shifting of the denture upon its supporting tissues in order to guard against trauma and atrophy. There was a time when it was seriously contended that the shifting of a denture upon the ridge induced beneficial massage. Our present view is directly opposed to this, and it should not be necessary to point out the evil effects of shifing denture bases.[2]

With dentures so constructed as to assure balanced occlusion,[3] let us inquire into the effect of the forces from the horizontal directions during mastication. Any force from the mesial direction on the working side would, owing to the semicircular form of the ridge, have a tendency to rotate the entire denture, the working side moving posteriorly and the balancing side anteriorly. Similarly, a force from the distal direction would tend to thrust the mandibular denture anteriorly on the working side and pos-

*Read before the Section on Full Denture Prosthesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 26, 1927.

1. Wright, W. H.: Some Observations of Jaw Relationship to Be Considered During Full Denture Construction, J.A.D.A., 9: 209 (March) 1922.

2. French, F. A.: Cusp Trauma, J.A.D.A., 11: 792-801 (Sept.) 1924.

3. Sears, V. H.: Balanced Occlusions, J.A.D.A., 12: 1448 (Dec.) 1925.

teriorly on the balancing side. A force from the buccal direction on the working side would be resisted by the elongated mound formation of the alveolar ridge on the working side, and likewise, to a lesser degree, on the balancing side. A force from the lingual direction on the working side would be resisted by the elongated mound formation of the working side, and likewise, to a lesser degree, on the balancing side. In the last instance, the ridge formation on the balancing side would be effective for retention only when combined with a downward force sufficient to retain the denture in contact with the ridge on the balancing side.

Fig. 1.—Mandibular denture.

It will be clear, from these considerations, that the stabilizing effect of the ridge in the bicuspid and molar regions against forces in a mesiodistal or distomesial direction is extremely small; while the stabilizing effect against forces from the buccal or from the lingual direction is much greater, this depending on the form and firmness of the ridge. It follows that horizontal components of forces acting from the mesial or from the distal direction are the most unfavorable to stability, and we should do all that is possible to minimize them. A force from the mesial direction on one side and from the distal on the other side is a combination which tends very decidedly to shift the base upon its support. Such a rotational movement is very destructive to supporting tissues, and its possible occurrence should be carefully avoided in the designing and arranging of teeth.[4] All guidance should be at such angles to the ridge as to direct the resultant forces of mastication as nearly as possible perpendicularly to the supporting area. This requirement clearly indicates the necessity for the use of channel teeth and further indicates that the channel teeth should possess relatively low cusps.

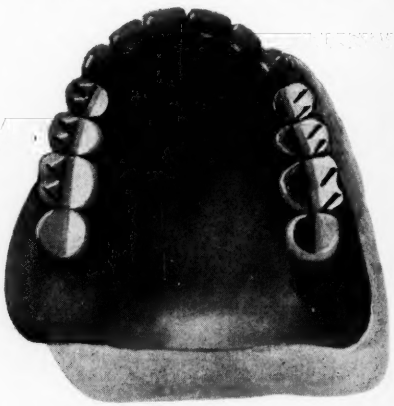


Fig. 2.—Maxillary denture.

The chief objections to the use of so-called anatomic tooth forms for prosthetic dentures are as follows: Anatomic forms require the interlocking of opposing cusps and grooves in such manner that, in the working position, the mesial slope of the maxillary cusp opposes the distal slope of the corresponding mandibular cusp. With the opposing cusps

4. Sears, V. H.: Some Fundamental Factors in Tooth Articulation, J. Dent. Res., June, 1928.

interlocked in this conventional relation,[5] any degree of anterior or posterior movement of the mandible exerts a force upon the denture base in an unfavorable direction.

The mandible does not travel in the same path with each lateral masticating stroke, but possesses a varying element of protrusion, depending largely on where resistance is felt or anticipated. No single track or path can be said to be the patient's habitual chewing path. With anatomic forms, any closing pressure in the protruded lateral relation would tend to thrust the mandibular

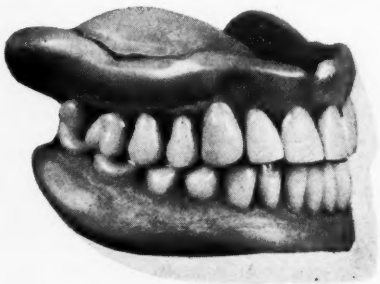


Fig. 3.—Occluded dentures.

denture posteriorly on the working side. It might be contended that, although the cusp inclines would tend to force the mandibular denture posteriorly, the resistance of the food would tend to force the denture anteriorly and the two forces would equalize each other, a vertical force resulting. Analysis will show that the resistance of the food may seriously aggravate the condition. If the resistance offered by the food should be just sufficient to neutralize the thrust at the middle of the masticating stroke, we should have the unfortunate circumstance of an anterior thrust during the first half and a posterior thrust during the second half of the masticating stroke —a truly destructive set of denture movements upon the supporting tissues. To satisfy oneself that, with anatomic cusps, there is a thrust of the mandibular denture toward the posterior, it need only be noted that, when the dentures are constructed in centric jaw relation, the mesial slopes of the mandibular cusps invariably wear smooth facets.

During the movements of mastication, two things or one of two things must happen: either the opposing teeth must glide upon each other or the denture base shift upon the supporting

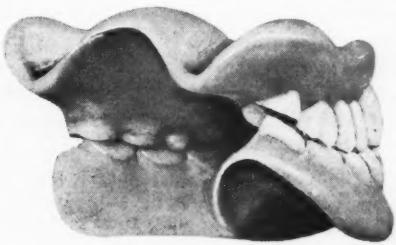


Fig. 4.—Right lateral occlusion.

tissues. Whenever the opposing teeth lock in such a way that they do not readily glide upon each other, there is always a tendency for the denture bases to shift, causing injury to the tissues. It will be appreciated from the foregoing that the establishment of balanced occlusion alone will not eliminate trauma to the denture-supporting tissues. Masticating forces will be destructive unless our tooth forms can be made to dissolve the resultant masticating force into components acting favorably upon the supporting tissue. The tooth forms herewith illustrated and described represent the culmination of six years of experiment and earnest effort toward reducing the tissue-destroying effects of artificial teeth.

5. Gysi, Alfred: Special Teeth for Cross-Bite Cases, Dent. Digest, 33: 672 (Sept.) 1927.

With the premise of the preceding pages on what should be incorporated and what avoided in artificial teeth to fulfil the requirements of balance, stability and efficiency, let us show the advantages of the channel type of tooth.

The absence on channel type teeth of interfering projections on the occlusal surfaces permits the opposing teeth to glide smoothly on one another from the centric position to the position of incision (and the reverse movement) without the usual degree of thrust on the denture. There are no mesial mandibular cusp slopes upon which the presence of a resistant bit of food would cause a posterior thrust of the mandibular denture. The closing force exerted upon the channel tooth is directed upon the ridge at a favorable angle; which enhances the stability of the denture.

A limited lateral freedom of movement is made possible by a horizontal surface at the base of the channel. The mandibular cusp can thus be made to glide laterally to the extent of the width of the channel base. To meet this specific requirement, there has been manufactured an incisal guide to facilitate the setting and milling of channel teeth. This guide has a horizontal plane which permits of variable lateral freedom of movement according to the physiologic requirements.

The ability of the tongue to exert a retaining influence is taken advantage of in the prism-like forms of the mandibular teeth. The lingual surfaces of the right and left mandibular posterior teeth are always diverging, and these diverging surfaces are continuous with the lingual surfaces of the body of the denture. The pressure of the tongue against these diverging surfaces causes a resultant downward force which aids in keeping the denture seated.

Maximum tongue space is provided for by the complete elimination of the mandibular lingual cusp, which permits the buccal cusps to be placed farther toward the lingual side. This, in turn, brings the maxillary teeth farther toward the lingual side, where the masticating forces are better resisted. When the maxillary ridge is narrower than the mandibular, which is so frequently the case, this feature becomes one of importance. The prism-shaped mandibular tooth fitting into the channel of the maxillary tooth possesses all the virtues of the so-called cross-bite arrangement without its disadvantages. In fact, the prism-in-channel arrangement may well be considered as a special cross-bite tooth form with all the advantages of the normal cusp arrangement.

The absence of any boxlike cavities, which entrap small masses of food, permits of mastication with less force than is necessary with anatomic forms. Repeated experiments have shown that no matter how small these boxlike cavities may be, the patient experiences a sense of "jamming," which necessitates, or at least encourages, greater application of force upon the supporting ridges. Furthermore, the absence of boxlike cavities seems to encourage the patient to do his masticating with the opposing cusp surfaces in contact throughout that part of the masticating stroke during which the greatest force is exerted. With dentures properly balanced, the value of this is considerable.[6] Also, the small buccolingual dimension of the mandibular teeth offers small resistance. Mastication may thus be made possible

6. Hanau, R. L.: What Are the Physical Requirements for and of Prosthetic Dentures? J.A.D.A., 10: 1044 (Nov.) 1923.

in such manner that the edentulous ridge is stimulated without being traumatized.

Efficient cutting of food is assured by the action of the sharp edge of the mandibular tooth gliding on the sharp triangular projections of the opposing maxillary tooth surface. Fibrous foods are particularly well cut by this action. Mashing is accomplished at the end of the stroke as the lingual surface of the mandibular cusp approaches the buccal surface of the maxillary lingual cusp. This cutting and mashing of food particles with each masticating stroke is extremely interesting, but will not be elaborated on here. A study of the accompanying illustrations will reveal the action of the converging and diverging blades and the shearing effect at the convergence of the blades.

Some may doubt that the teeth here illustrated appear natural in the mouth. It is a positive fact that many dentists have looked at such dentures and expressed themselves on the esthetic effects without discovering anything exceptional until the dentures were removed from the patient's mouth. Out of the mouth, these tooth forms may look queer to the trained eye of the dentist, but they elicit no comment on the part of the patient.

The ease with which the channel teeth may be articulated is surprising. Any width of maxillary anterior teeth with any width of mandibular teeth, or any degree of horizontal overbite combined with any degree of vertical overbite, will be found possible without encountering the usual difficulties in arranging the opposing posterior teeth. All problems of mesiodistal relation of opposing cusps are eliminated in the channel tooth form, and the time required in arranging the teeth is thereby reduced.

The channel form makes it possible to use one mold of tooth for a wide range of cases, thus materially decreasing the number of molds required. An additional bicuspid or molar may be added to the set to increase the total anteroposterior length, or teeth may be left out to shorten this length without introducing complications. If the length is to be reduced less than the width of one tooth, the proximal surfaces can be ground to accomplish this result, and either the maxillary or the mandibular teeth can be independently altered without the usual complications. As stated before, the channel tooth obviates the necessity for any special consideration in "cross-bite" cases.

The channel form makes it possible in all cases to incorporate a nearly horizontal incisal guidance. This assures not only an immediate advantage but also a favorable condition when subsequent settling of the dentures causes the mandibular teeth to assume a protruded position.

The form of the maxillary posterior molar here shown meets the requirement that the forces of mastication should be directed on those portions of the mandibular ridge best suited to bear force. We have already called attention to the fact that, in the posterior molar region, the mandibular ridge turns upward and is more thickly overlaid with soft tissue. This suggests two good reasons for minimizing the pressure on this area and for permitting the ridge anterior to this area to bear the greater burden: 1. The thicker and more resilient soft tissue is less suited to withstand pressure without unseating the denture base. 2. The upward turn of the ridge causes the closing force to be unfavorably directed when resistance is encountered in the posterior molar region and tends to slide the man-

dibular denture anteriorly. The comparatively more obtuse angle of the channel in this posterior maxillary molar causes the opposing surfaces to separate in the working position without interfering in any way with contacts on the balancing side and in protrusion.

We now have before us the principal claims for the channel tooth. It remains only to meet two plausible objections and to express the hope that others will make further improvements on the design here presented. It may be argued that if the elimination of cusps as viewed from the buccal aspect will reduce trauma, one should eliminate all cusps. One answer to this is that, with divergent condyle indications it would then be impossible to obtain balanced occlusions during function.[4] The other objection to the channel tooth form, as expressed by a few dentists, is that the presence of narrow mandibular teeth would increase the required number of strokes necessary to accomplish mastication. This is a theoretical objection that is not justified by experience, but even if it should become necessary to make more masticating strokes, assuredly two light strokes would cause less trauma to the ridges than one heavy one, and digestion would be more satisfactory because of more complete insalivation of the food.[7]

CONCLUSION

The intelligent use of channel teeth will bring out some matters of interest and importance that have previously escaped the attention of the dentist, and after a little experience, he will be able, even with ordinary teeth, to reduce materially the usual destructive effects of shifting bases. Those who are interested in the future development of prosthetic dentistry will find here additional scientific means for safeguarding the integrity of the denture-supporting tissues.

200 West 59th Street.

DISCUSSION

Felix A. French, Ottawa, Canada: The artificial form of posterior tooth which Dr. Sears is advocating appeals to me as having very practical application in denture construction. A study of cusp trauma will serve to substantiate the statement he made that the forces which tend most to unseat dentures and which are most injurious to supporting tissues are those exerted from the mesial and from the distal directions. The use of channel teeth, as he calls them, practically eliminates this source of trouble. They also permit that free play in centric position which is so desirable in artificial teeth. While I have used channel teeth in my practice but a very short time, and am not yet in a position to make any definite statement as to their masticating efficiency, I can clearly see that they are positively indicated in certain cases, and if clinical evidence generally substantiates the claim that they are as efficient as the forms now in general use, I can foresee that they will sound the death knell for anatomic tooth forms in full denture construction.

A. Alfred Nelson, Detroit, Mich.: I find in my practice that channel teeth are a panacea for all ills in prosthetic dentistry. That is my experience so far. It is my intention to use them in every single case that I have to deal with for the next six months, to give them a real test. We have one man in the audience who knows more about artificial teeth than anybody else. He wears them. Dr. Boyce has a set of channel teeth in his mouth. We should like to hear from him.

A. E. Boyce, Tuscola, Ill.: Dr. Sears was good enough to send me a set of posterior teeth to try out in my own mouth. In the last seven years I have used up more than $50.00 worth of teeth in experimentation in my own mouth. I did not get this case finished until last week, so the length of trial is not long, but, in that short period, I was surprised, greatly so, at the efficiency of them. I was surprised at the ease, I was surprised at the absence of cusp interference and of tongue interference. To look at them, you would think that the change in design of

7. Sears, V. H.: Diet for Denture Patients, J.A.D.A., 13: 1266 (Sept.) 1926.

the lower teeth would bother the patient. Really, you do not notice that the lower teeth are any different shape from the natural teeth or the anatomic form of artificial teeth. I made a little experiment in efficiency. I went over to the meat shop and got a piece of dried beef and cut it about three-sixteenths inch thick. Then I took out the center muscle so that the texture would be as nearly the same as possible, and I divided that into three boluses, trimmed them down and weighed them until they were all the same weight, so that I would have exactly the same bolus for each experiment. I chewed two of the boluses for the same length of time and compressed them as much as I could in my mouth, and took two bottles and put the same amount of water in each bottle and dropped the boluses into the bottles. The third bolus was kept intact to show the size of the boluses that were chewed. Those bottles are on exhibition if you care to go to the booth and look at the difference in efficiency, one chewed with the channel teeth, the other with the set I have been wearing now for about three years and which have been, I thought, efficient and highly satisfactory. They were made practically on the same model. I merely took a model from the teeth that I was wearing to construct the channel teeth. I see great possibilities in this new tooth form. There may have to be some modification made, but, if they are properly worked out, I see great possibility for channel teeth.

R. O. Schlosser, Chicago, Ill.: When anybody says that he has found a panacea for all dental ills I can't keep my seat. I do not doubt for one moment the sincerity of Dr. Sears and those who have discussed his paper. We should encourage originality and individuality when it finds its way into a method that gives us something new, but when at this early day it is hailed as a panacea, I protest. If we must depend only upon the things that we ourselves experience and if we cannot learn something by proxy, we are not on the right track.

Dr. Boyce: I do not advise anybody to lose their natural teeth, but, as I said to Dr. Schlosser this morning, what we need is an edentulous national prosthetic association.

J. T. Martin, Muscatine, Iowa: The mistake which has been commonly made lies in accepting natural denture conditions as standards for artificial denture construction. When artificial dentures become necessary, conditions are entirely changed and we cannot reproduce them completely. We must build restorations, therefore, under such altered conditions that failure to recognize the changes and to build in accordance with their requirements leads into error. In some particulars, it is possible and desirable to reproduce closely original or natural denture conditions. In others, successful artificial denture construction requires definite departure from those original conditions.

I have had no experience with channel teeth; but we must recognize the conditions which exist when artificial dentures are necessary, and then build to meet the requirements of those conditions.

Dr. Sears (closing): I thank you for the charitable reception you have given this Bolshevik idea. Dr. French's discussion was almost a "whitewash," with the exception that he doubted that the channel forms could be as efficient as the present tooth forms. No comparative claims were made by me, but Dr. Boyce has answered that question. I have tried not to make any very definite claims for them. I have tried to curb my enthusiasm and have deleted from the vocabulary such words as Dr. Nelson used, such as panacea. If you know Dr. Nelson you will know that it is merely an expression of his effervescence and conviction based upon his experience. Dr. Boyce's experience is the most valuable of all, and his report is the most complete and definite, and I want to thank him for making of himself an experimental laboratory.

As for the modification Dr. Boyce suggests, I am certainly hopeful that you men will figure out more modifications with the idea of arriving at something better. The fundamental idea I accept absolutely; as to the design I am not positive, even though I have made modifications for many patients throughout the last six years.

I have tried forms with the channel on the bottom instead of on the top. There are several reasons why they don't work so well. One you can see at a glance. Were you to put the channel below and the prismlike form above, they would not look natural; it would be impossible to give the appearance of natural teeth as you saw them on the screen.

INFLUENCES OF MANDIBULAR MOVEMENTS ON BALANCED OCCLUSION*

By ALEXANDER H. PATERSON, D.D.S., F.A.C.D., Baltimore, Maryland

ELEVEN years ago, while I was making a study of scientific articulating problems in the construction of full dentures, the thought occurred to me that it might be possible to grind on the bite blocks curvatures that would aid in the arrangement of the artificial teeth and permit the mandible to move as it did with the full complement of the natural teeth.

Further, it seemed that, if the occlusal surfaces of the artificial teeth were arranged to occlude perfectly with the curvature established on the lower bite block, the long axis of the teeth would be directed to some central position in or beyond the head, and the teeth would then be in the most advantageous position to produce balance and resist stress. As the theory seemed plausible, a practical method of procedure to obtain the desired result was originated.

METHOD OF PROCEDURE

The usual technic in the preparation of the upper bite block was performed,[1] and the distal surfaces of the bite rim were curved to approximate the natural curves. The lower bite block was then adjusted to the curvature approximated on the upper. The occlusal surfaces of both bite rims were then grooved out, filled with a paste of carborundum and plaster, placed in the patient's mouth and milled. When the milling was completed and the jaw had assumed the rest position, marks were placed anteriorly at the median line and buccally as guides in assembling the bite blocks in preparation for the mounting.

MOUNTING AND ARRANGEMENT OF TEETH

No particular mechanism is necessary in mounting the case. Dependence is placed absolutely on the curvatures developed, and any instrument having an open and close movement is suitable.

After the mounting, the upper bite rim is trimmed away and the base-plate utilized in mounting the teeth. The teeth are arranged to occlude with the ground occlusal surface of the lower bite block, with the incisal edges of the central incisors and the buccal and lingual cusps of the bicuspids and molars in absolute contact, the lateral incisors slightly above and the cuspids slightly below the established occlusal plane. A new base-plate is constructed to be utilized in mounting the lower teeth. The bite block is preserved to test the accuracy of the work, if, for any reason, the upper teeth are disturbed in the arrangement of the lower. The lower teeth are arranged to occlude with the established upper.

*Read before the Section on Full Denture Prothesis at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 25, 1927.

1. Paterson, A. H.: Construction of Artificial Dentures, Dent. Cosmos, 65:679 (July) 1923.

During the process of the arrangement, the instrument selected is maintained in the stationary position. No adjustment or movement is necessary. The only essential is to reproduce the curves, which once reproduced, are sufficient to establish a well-balanced articulation, with an approximation close enough to secure a harmonious action between the curves and the condyle in the glenoid fossa.

MANDIBULAR INFLUENCE

All of the individual characteristics of the various movements of the mandible are registered on the ground occlusal surfaces of the bite blocks, and when the curves are properly established and utilized as a basis for tooth arrangement, they do not in any way hinder mandibular action. The freedom of action may be observed in a practical demonstration by starting the milling with an excess of milling material and noting the gradual relaxation of the muscular tension and the development of a free, easy swing of the mandible as the milling approaches the point of completion.

The copy of the path upon which the mandible moves automatically establishes a balanced occlusion of sufficient efficiency to meet all practical purposes. A further milling of the finished product directly in the patient's mouth will add to the occlusal surfaces of the artificial teeth the individual characteristics of mandibular movement sufficiently to establish masticatory efficiency. The acceptance of the ground occlusal curves as a basis for articulation does not disrupt balanced occlusion. It supplies the very soul of its development, and, if this basic fact is disregarded and arbitrary curves are established, it is impossible to attain the same degree of proficiency.

A test for balance in the finished dentures discloses the fact that it actually exists and embodies the principal requirements generally conceded necessary. These requirements are understood to be balanced occlusion in three different positions of the working bite: anteroposterior and right and left lateral.

FUNDAMENTALS

In establishing the curves, a knowledge of certain fundamentals, two of which are most important, is essential, and the operator must have a thorough understanding of each before success in the performance of the technic can be expected. First, he must have a broad, comprehensive idea of the anatomic structure of the mouth and its related parts, to visualize the location and direction of the imaginary curve of Spee, in order to establish a mechanical curvature on the occlusal surfaces of the bite rims that approximates the imaginary curvature as seen in the mouth. Secondly, he must understand thoroughly the most pronounced movements of the mandible in order to interpret correctly the accuracy of the movement as the process of establishing the curvatures on the occlusal surfaces of the bite blocks is developed.

To master the essentials stated above does not require any great amount of mental endeavor. Every practitioner unconsciously absorbs a fund of information that gives him a general conception of the anatomic parts of the mouth with which he is mostly concerned. All he needs in addition is an anatomic knowledge in detail, which can be obtained by a review of the work taught in school. A suggestion for study would be the first chapter of Wilson's book on "Dental Prosthesis."[2] This

2. Wilson, G. H.: Dental Prosthetics, Ed. 4, Philadelphia: Lea & Febiger, 1920.

chapter contains all of the fundamentals.

Having attained this knowledge, the operator will be in a position to regulate the grinding, and, under no circumstances, will the milling ever develop curvatures in the reverse direction.

SIMPLICITY A NECESSITY

The method offers a simple solution in developing a practical articulation that meets the needs of the practitioner unprepared to manipulate the more complicated mechanisms, and it eliminates the necessity for a tremendous amount of study in mastering a working knowledge of the intricate mechanisms presented.

The great mass of practitioners are not qualified to grasp the intricacies surrounding a mathematical mechanism that tests the ability of a trained mechanician. Neither does it seem that some of the originators of these mathematical mechanisms are qualified to grasp the intricate problems that confront the profession.

Much valuable information has been obtained during the process of the development of the various types of machines. They have all contributed largely to a better understanding of the science involved. Some have recognized the crying need of the dentist and have originated machines that are comprehensive and easily manipulated and have solved the problem in a great many instances, but the intricacies of many of the machines are beyond the understanding of the average man.

SUMMARY

This method establishes curvatures that make possible a close approximation of the path upon which the mandible traveled with the natural teeth in the mouth; and because of the establishment of the curves[3] on the bite blocks, automatic balance is produced.

The milling of the planes equalizes the bearing of the occlusal surfaces of the bite blocks throughout their full extent and gives a means of establishing centric occlusion with some degree of accuracy. It also harmonizes the action between the curves and the condyle in the glenoid fossa.

The hard occluding surfaces of the bite rims facilitate tooth arrangement and set the teeth in the best possible position to resist stress. It reduces the amount of mental effort, and suggests a time saving method affording greater accuracy.

809 Medical Arts Building.

DISCUSSION

A. K. Parks, Montgomery, Ala.: The technic described by Dr. Paterson would be very effective in recording the mandibular movement of an edentulous mouth which we expected to remain edentulous; but what we wish to do is to get a set of teeth for that mouth. The movements he has made have been on a plane and do not involve the opening movement. Any deviation of the opening and closing position from which we start materially interrupts every other thing we do after that. A good definition of centric occlusion would be that position of the natural teeth from which we cannot move without involving the opening movement. Condyle paths recorded on planes sometimes show as much as 25 degrees error when the opening of the cusp depth is added.

Walter E. Beyer, Indianapolis, Ind.: Dr. Paterson has given us an excellent idea concerning the use of bite blocks as an aid in the arrangement of artificial teeth. To advise using any articulator locked in centric occlusion is almost the same as asking for a return of mid-Victorian methods. To arrange the upper teeth to occlude with the ground occlusal surface of the lower bite block is a very good start, but Dr. Paterson fails to tell us how much overbite each case requires.

3. Paterson, A. H.: Establishing the Prosthetic Curves of Occlusion, 14:1197 (July) 1927.

This method would make every set-up an end-to-end bite. If an anatomic articulator were used, far better results could be obtained. We know that the steeper the curve is, the longer the overbite, and the shallower the curve, the shorter the overbite. After the bite blocks are made, the bite should be taken and central occlusion established. Then the face-bow must be used and the case mounted on an anatomic articulator. With the bite blocks, the protrusive bite is obtained, to register the condyle paths. The Gysi gothic arch checks central occlusion. At this point in the procedure, Dr. Paterson's technic for grinding curvatures on the bite blocks can be used to advantage. Balanced occlusion must also be tested and an accurate way to do this is to take a check bite and remount the case on an anatomic articulator. If the case is balanced, the process is complete after milling. Dr. Paterson has emphasized a knowledge of certain fundamentals before success with his technic can be expected. Then, he states that mastering the essentials does not require any great amount of mental endeavor. According to Dr. Giffen,[4] it is doubtful that any man can acquire the technic of balanced occlusion with less than ten years' experience. Among the fundamentals, visualizing the curve of Spee is mentioned. This should be done with the aid of an anatomic articulator, and not merely estimated at random. Masters of the various arts do not lose greatness by using mathematical means. Even in as free an art as sculpture, mechanical measurements are used. Rodin, the French genius, has been known to measure a completed ear with calipers, and, finding the angle a trifle different from that of the model, cut it away and carve another that is mathematically correct. I agree with Dr. Paterson that a simple technic for the average practitioner is greatly needed.

Rudolph L. Hanau, Buffalo, N. Y.: I appreciate an opportunity to say something which may offset the ideas of Dr. Paterson, which, to me, seem medieval. I shall give only the impressions left on me as an engineer. Dr. Paterson will not take an exception to my procedure for we have already agreed to disagree. For years the National Society of Denture Prosthesis has worked hard to free itself from the chaos of irrelevant ideas advanced by many articulator theory interpreters and sponsors. In a way, the society has been successful in vitiating some of the most preposterous theories, one of which, I believe, is the Wadsworth theory, for which Dr. Paterson stands. We do not doubt Dr. Paterson's sincerity; nevertheless, I, for one, cannot look on him at the present moment as a keen analyist among the scientific researchers. His views, as I see them, do not justify him to do the thinking for the average dentist, for it appeared too clearly that he did not correctly analyze the problems at hand. I challenge the remarks Dr. Paterson made about mathematics, etc. If your professional problems are in any way to be identified with the exact sciences, you cannot discard some of the implements of science, such as physics and mathematics, wherever they are essential. It is not satisfactory to decorate a thesis with some formulae and four-syllable words. We often have to employ physics and mathematics in our investigations. It does not necessarily mean that the practitioner could not be given a practical applicable résumé devoid of superfluous formulae and complications. If the practitioner has to be taught physics and mathematics, he should be taught it in the language of physics and mathematics; there is no need for a special dental geometry or dental mathematics. I already heard mention made of a Munson, Hall, House and Needles geometry by members of the profession. Such geometric appendages were amusing revelations to me, when I became associated with the dental profession. Dr. Paterson made one particular statement which certainly belongs to the dark ages, namely, that you may use almost any instrument and yet achieve results. We know that you cannot do it, on account of human limitations; not to speak of the limitations of the average mind, to which possibly Dr. Paterson refers when he speaks of the "average dentist." Few of us—I may venture to guess one in a million—are able to see in four or five dimensions. For most of us, it is very difficult to think and analyze in three dimensions. That may be a reason why it was so difficult to explain the function of articulation, which occurs in three dimensions. These meetings are the place to settle our arguments. It is a much more natural

4. Giffen, W. A.: Registration of Mandibular Movements with Plastic Material, J. A. D. A., 14:1480 (Aug.) 1927.

place than outside at the exhibition booth, which is intended for commercial, rather than for professional discourses. I beg you to settle your articulation problem right here. It can be best done by vitiating such reactionary teachings as were enunciated by Dr. Paterson. I trust that on some other occasion I may have an opportunity to explain in more detail some of the still pending problems of articulation.

C. A. Reith, Pittsburgh, Pa.: Dr. Paterson has given us the most advanced and the most scientific step so far taken. I have been applying Dr. Paterson's idea for a number of years, and it is the only method that I use in doing this work. But Dr. Paterson has not carried it quite far enough to give him and to give us, possibly, the results that we are after in anatomic and balanced occlusion. I have used the Hanau instrument and nearly all the instruments that have come out on the market for the last ten years or more, and I have discarded the Hanau instrument and the Munson instrument because I have found that there is no instrument made, and never will be, that will do the work of brains. Dr. Paterson's method of grinding in the bite blocks with the carborundum powder and plaster is, in my opinion, the only true way that we can get individual mandibular movements, but it must be carried on with both bite blocks, not with one. There must be sufficient freedom of movement so that at no point in the entire mouth is there contact with the compound; otherwise, we interfere with the individual movements. Our plaster and carborundum powder must be the only surface in contact, and it is milled in by the patient with his individual movements in a gentle way, without pressure, until that entire movement is established. The next and the most important step is the reproduction of that movement onto your instrument. It is here that Dr. Paterson has not developed the method to the extent that it is satisfactory to Mr. Hanau or to you men who naturally want anatomic individual movements on the instrument. It is now up to you whether you use a Hanau instrument or any other instrument to reproduce the movements, and if you can't do it by the manipulation of the degrees on the instruments, you must make the instrument individually fit the case to the blocks that you have ground in. I do this with an addition to my instruments of amalgam, or it may be done in any other way that you wish to do it, to reproduce the condyle movements, incisal movements, protrusive movements, retrusive movements and lateral movements as you find them in the bite blocks. They must be reproduced on the instrument; then, you have an anatomic instrument individual to every case, whether it be a Hanau instrument, a Munson or any other. The case must be reproduced on the instrument, then you have as nearly 100 per cent perfection of individual movements and anatomic occlusion and articulation as possible. Dr. Paterson's paper is the best thing that we have heard, if we can only develop it a step further and make a practical application of his suggestions.

J. W. Crawford, Milwaukee, Wis.: I would like to ask Dr. Reith what instrument he uses.

Dr. Reith: You are asking a question that I cannot answer as I cannot show you how I use the instrument and how I prepare my instrument so that I can use them all. I have a Hanau instrument, and use it when the others are full. I use them all. I can use a Gysi just as well as any other by reproducing the condyle movements on the instrument.

C. J. Stansbery, Seattle, Wash.: Dr. Paterson describes grinding in of bite rims. What is the position in which he grinds them? In centric occlusion. He goes into lateral position, a position that the jaw cannot occupy when teeth are made because their cusps are in the way. How can he perform a protrusion on a curve open at the height of centric occlusion when the anterior teeth are in the way? He is working in one plane, while the mouth functions in two or more. The point left out in these relations is that the height of the cusp is not taken into consideration. Dr. Paterson adjusts his instrument in lateral excursion on the plane of centric occlusion. The direction of the condyles for that plane is not the direction of the condyles when the tooth cusps are forcing an opening; here, we have another condyle direction entirely different of which no registration has been made. We must have the opening component put into that check bite before we can make any adaptable instrument imitate the mouth in its movements. After the instrument is adjusted, no matter what instrument we use, what are we trying to do? We are trying to make the instrument do what the patient does. We get a

centric occlusion. We can maintain centric occlusion on a plane line or two blocks of plaster, but as soon as we begin to move and go into other positions, there is only one way possible to set our instrument. The relation which the patient's maxillae and mandible are to have one to the other, that is, with the mandible in the position that it is going to occupy when teeth are set up in working relation, necessitates taking a check bite in that position, and that position calls for an opening component. Registrations on instruments derived from check bites taken in a single plane cannot give it.

A. Y. Russell, Baltimore, Md.: I have been closely associated with Dr. Paterson for a number of years and I know the type of work he does. I know that his bite plane is a step in the right direction. A great deal has been said here about help for the average dentist. This bite plane has been, and is, the greatest help up to this point. He may go a little further in obtaining the individual movement, not the average, of the individual patient. That is the mandible excursion of the individual patient; but up to this point it has been the greatest help, and I want to go on record here as saying that I know Dr. Paterson has done some great work along this line.

J. S. Miller, Trenton, N. J.: For many years—when I say for many years, I mean for as many years as I have known Dr. Paterson and his methods—I have used this method. He has done much for us, and I say, strength to his arm and his brain. Stating that one cannot set up teeth on the curve is wrong. It can be done; it is being done, provided the curve is ground properly and with care. As to Mr. Hanau, I have his articulator and I believe he has done much for our profession. Often, I have set teeth up according to his method and ground them according to Paterson's method, and found them correct. Hanau's articulator is a wonderful instrument. There is no question about that, although it is rather complicated. Dr. Paterson's method of grinding in plates is ideal and very simple.

Dr. Paterson (closing): It is not possible today for me to meet the issues which have come up following the reading of this paper, nor am I desirous of doing so. You men do not get my point, with the exception of those who have helped me. I have some knowledge of the dental profession. I have made a study of it for the past sixteen years and have been a teacher for the same length of time. I am not condemning all the theories on this articulation problem; neither am I condemning the articulators. In my paper I have not mentioned the word articulator. I condemn no scientific method whatsoever; but I have presented a scheme of construction that can be developed with a small amount of application. This is the secret of the whole thing: If you will do what I tell you and study the first chapter of Wilson's Prosthetic Dentistry and apply it to this curvature method, you will make good dentures in a minimum amount of time, and you will give to your patients an efficient masticating apparatus that will increase your successes 100 per cent. If you are having trouble and you want a method that you may rely on, and with a minimum amount of effort, grind the curves and try them. I do not say that this will solve the problem, but my paper gives a close enough approximation for good masticatory efficiency. I did not say it solved all the problems. Neither do any of the scientific machines in existence today. We have nothing yet that can automatically do this. One of my friends here has correctly said: "It is the brain behind this thing that produces a good set of dentures." The average dentist today does not know even the fundamentals of articulation. How, then, can he correctly use a scientific apparatus? You must know articulation, and my aim today has been to help you.

FURTHER STUDIES ON THE ETIOLOGY OF PULP CANAL INFECTIONS WITH SPECIAL REFERENCE TO DIAGNOSIS AND TREATMENT*

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WE are fully conscious of the fact that a research report, if it is to appear dignified and scientific, should attempt no more than a presentation of cold fact experimental data. At this time, the work begun during the past year is not finished and a complete report cannot be made. The inquiries for more complete details and practical applications of our previous work have been so numerous during the year that we have decided to depart somewhat from the more orthodox idea. We will briefly review our past experimental data so that it may be more readily linked with the results obtained during the past year and the work that we desire to do during the coming year.

We have now been studying the problem of pulp involved teeth for eight years. It must be obvious that, in our earlier studies, it was necessary to review some of the conflicting data, and carry on tedious and long experimental investigations with the hope of discovering the cause of the discrepancies apparent among seemingly competent workers. Briefly stated, it was soon observed that the microscopes, test tubes and petri dishes were reliable, but that the discrepancies were, as a rule, due to the human element attempting elaborate interpretations without a correlation of all the facts. Fortunately, the majority of observers and research workers who are studying the problem in groups in the wholesome surroundings of our schools and scientific foundations are, and have been, open-mindedly seeking the truth. The biased opinions and ill-advised reports have usually emanated from either private individuals inadequately prepared to do constructive research work or from certain hospital clinics where it was impossible to study the problem in its true perspective and proper proportions. We have aimed at a safe and sound solution of the problem consistent with health service and the best interests of the practice of dentistry.

When we first turned our attention to the study of pulp-involved teeth, the three outstanding subjects discussed by the dentists were: 1. Is a pulpless tooth a dead tooth? 2. Do all pulpless teeth become infected within a few months regardless of the method of treatment? 3. Can infected dentin be sterilized?

There were seemingly conscientious advocates on both the affirmative and the negative side of these questions, but the experimental data supporting the individual opinions were usually incomplete

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or entirely absent. Our group reviewed the data pro and con and compared it with our own clinical observations until we ceased to have fixed opinions about the subject, for there was indeed evidence supporting both views. You will appreciate how difficult it is for an investigator to accept even his own results when such results are in contradiction to his established opinions. We suspect that such findings have at times been thrown out as due to probable errors even by the most conscientious observers. We knew, too, how difficult it is to omit questionable results if such results are in accord with the worker's point of view. The fact, then, that we had finally come to a position where we had no definite ideas as to the correctness of the one or the other view led us to believe that the time had come when it was safe for us to begin the study of the subject. We were sure that we had at least one essential qualification: We knew not and knew that we knew not.

STUDY OF THE QUESTIONS

Is a Pulpless Tooth a Dead Tooth?—The details of our studies have been published elsewhere in the literature and only a brief review will be included in this report. The question whether the pulpless tooth is a dead tooth is as complex as the definition of life itself. While no complete definition has as yet been given explaining life, we believe Herbert Spencer came the nearest to it when he said, "Life is the continual adjustment of internal relations to external relations." If this definition were applied to our subject, the question at once arises, Can satisfactory substitutions for the vital pulp be made to maintain continuous adjustment of internal and external relations? Teeth from which the pulps have been removed, so that the receding foraminal membranes have completely sealed the apical foramina with cementum, probably most nearly approximate this successful continuous internal and external adjustment. The anatomy of the root is such that, even in the obvious failures of root surgery, adjustments appear to be adequate with the exception of varying lengths of the more permeable apical quarter and in the exceptional accessory or lateral foramina. It is this part of the root that past pulp canal methods have failed to manage successfully. In fact, one seldom finds a complete set of roentgenograms of mature patients that does not give evidence in one or more roots of unsuccessful adjustments in the diffusible, or critical end. This portion of the tooth, when inadequately managed, may become toxic even in the absence of infection due to stasis of the circulatory elements. In the accepted definition of life, such teeth could quite appropriately be referred to as dead teeth. The odor of the pulp canal contents of our failures should satisfy even our most primitive test and conception of dead tissue. We all should agree that such teeth, without surgical aid, are at least a potential menace to the health of the patients. If it were not true that there is a well proved tolerance of the vital tissues for some foreign substances, such as some of the heavy metals and certain other insoluble materials, the average success of root filling would probably always be too low for the operation to be considered as good practice. But since on vital pulp removal favorable conditions are quite attainable, and since there are substances graciously tolerated by vital tissues, as proved by an abundance of clinical experience, it is quite evident that a technic of root surgery can be developed that will average well in effectiveness with the majority of other branches of surgery. The

small contact of vital tissue with inert material, unless extensively provoked with toxic invasions, becomes a negligible factor.

Do All Pulpless Teeth Become Infected Within a Few Months Regardless of Method of Treatment?—The idea that all treated pulpless teeth subsequently become serious foci of infections regardless of the method of treatment has been investigated and found not to be in accord with the facts as derived from our laboratory and clinical experience. It does appear from our work that too many such teeth, as treated by past methods, have become infected. The percentage of teeth that have become infected after attempted root surgery by past methods is much higher than it is where dead pulps have remained untreated for long periods. This is damaging evidence against our methods. While the seriousness of the situation has been very much overestimated by certain observers, it is true that if we, as a profession, are to make our contribution to real health service, it is absolutely necessary that we either improve our technic immediately or discontinue the practice. It is quite evident from our experimental studies and observations that the latter course is not expedient, neither is it necessary, and it is certainly out of harmony with the skill that the profession has acquired with the more mechanical aspects of dental practices.

Can Dentin, When Once Infected, Be Sterilized?—There is considerable evidence that the first reports as related to this problem were given without any real investigation. One who has carefully studied this problem is amazed at the question and wonders why it should ever have been discussed so voluminously. The facts are that the dentin between the cementum and the pulp canal is usually sterile as shown by culture and sections, with the exception of the superficial areas of the pulpal and canal wall. We have never been able to demonstrate the presence of organisms in dentin other than carious dentin. Now this is not to be interpreted as indicating that such dentin may not be invaded by toxins. There is abundant evidence that, while the dentin does not show organisms, it may become toxic, and where diffusion is possible into the surrounding vital area, such teeth may become a potential menace to the health of the patient. The dentin cannot support living organisms any length of time in areas where there is not a sufficient amount of diffusion to provide both the pabulum necessary for growth and the mechanism for the removal of the toxic end-products. Our work, then, would indicate that the fundamentals of success here would be surgical procedures intended to inhibit diffusion, and in cases in which the pulp has been dead for some time, provision must also be made for detoxication of the involved dentin.

We are trying to prepare you for the inevitable teaching of the present and near future, for we are convinced that very soon as much will be said of intoxication as has been said of infection. Past failures have been largely due to a lack of knowledge of this aspect of our problem.

It has been quite satisfactorily demonstrated from our own clinical and laboratory studies that, under certain conditions not yet well understood, inadequately treated pulpless teeth may involve the general health of the patient as a result of infection. The question arose in our group, "Can pulps be removed and root fillings be substituted consistently with health service?"

EXPERIMENTAL PULP REMOVAL

It will be evident that this information could not be proved in a laboratory but required a number of years of careful clinical observation. Enough work has been done during the eight years to warrant the statement at this time that where certain fundamentals and ideals can be approximated with suitable and adequate methods, the degree of success ranks well with the successes of other branches of surgery. In fact, we are quite convinced that it is seldom necessary to extract single rooted teeth of strategic importance. This should make eighteen or twenty teeth out of the full complement operable. Our experimental work, carried out on single rooted teeth only, was intended to demonstrate the possibility or impossibility of the operation. The success has been more than we had expected, and we are now trying to extend the operation to multirooted teeth. This, to date, has proved more difficult but by no means impossible.

At first, we believed it of greatest importance to find out whether the practice was rational if adequate measures were employed immediately after pulp extirpation, so frequently made necessary because of the presence of one or another form of vital pulp involvement. We held that it was more important from a research standpoint to think of the problem in terms of the millions of such involvements that will have to be managed in the future than to think only of treating those that had already become comparatively unmanageable. The success with the operation, on freshly extirpated cases, was so far beyond our expectations that we had the courage to attempt the operation in cases representing various degrees of periapical involvement.

TREATMENT OF INFECTED AND PUTRESCENT PULP CANALS

This part of the problem too had been challenged, but the fundamental issues have been so fogged with fiction emanating from office desk research rather than real investigations that much time had to be spent in "rainbow chasing" before one could study this part of the problem from a sound point of view. We have learned that if the involvement in the apical region has not progressed to a point where the structural changes have become so extensive that therapeutic measures, through the pulp canal, are impossible, it is well within the reach of rational therapeutics. In the single-rooted teeth the majority of those roots that do not lend themselves to therapeutic measures alone because of the above mentioned conditions, resection is frequently indicated, provided the operator knows the technic. The criticism that is made of the latter practice comes only from those who have had frequent failures owing to their not having a full appreciation of certain fundamentals that must be met if the operation is to be a success.

FUNDAMENTALS ESSENTIAL TO SUCCESS

The first of these fundamentals, which has been studied in our laboratories and has been quite generally accepted by other students of the subject, is the control of diffusion through that part of the root which we have been designating as the critical end. The term "critical end" refers to varying lengths of the apical quarter, this depending on the age of the patient, which permits of diffusion from the enveloping membrane through the cementum to the dentin into the pulp canal. We have proved that not only the foramina must be closed but also absolute sealing of the diffusible end to the dentocemental junction following vital pulp

extirpation, and to the very root end in other cases, must be accomplished if the operation of root filling without resection is to be highly successful. In case of resection, this principle is essential, for the diffusible end must be completely removed with other necrotic tissue in the surrounding area. The failures that have been frequently reported have been due, as proved by our clinical and laboratory experience, to the operator's leaving toxic portions of the root permitting the involvement to continue after the operation. We have practically eliminated diffusion through the root end of teeth not resected by carefully sealing the pulp canal to the dentocemental junction immediately after pulp extirpation, and through the foramina when the pulp has been dead for some time. In laboratory teeth, such sealed roots reduce diffusion to a negligible extent even under high pressure, which explains the favorable clinical results of roots similarly treated *in situ*. We have accomplished the same purpose on the planes of resection by burnishing silver solutions into such resected planes at the time of the operation. In the latter case, we have inhibited diffusion through the exposed dentin by the silver treatment. Our clinical experience, accompanied by suitable laboratory data, has been convincing as to the rationale of these practices. Briefly stated, the past failures of the practice have been due to the fact that these two fundamental requirements were not met. The clinical and experimental details verifying these statements have been published in the literature and our past research reports.

UNFINISHED WORK TO BE STUDIED DURING THE FOLLOWING YEAR

During the past year, we have tried to do two things: fiirst, humanize our work by carrying it directly to the profession not only through the literature but also by personal presentation to many dental organizations; and secondly, to try to standardize certain practices in order to bring our laboratory requisities within the reach of the practicing dentist. The interest that the profession has taken in this work has been very encouraging. In fact, the inquiries, through the mails, for complete details for the management of pulp involved teeth have been so numerous that we have attempted to standardize, as far as possible, routine procedures adequate for the several conditions that may arise.

STUDY OF THE EFFICIENCY AND EFFECTIVENESS OF THE VARIOUS NEWER AND IDEAL DRUGS IN PULP CANAL TREATMENTS

During our earlier studies, we observed that the induced leukocytic infiltration in the moderately involved periapical areas during treatment, if controlled, was rewarded with very favorable results. The speed with which evident regeneration of the involved periapical areas takes place when full advantage of this measure is taken has been quite phenomenal. It will be evident not only that such infiltration hastens the destruction of bacteria and toxic products, but also that in cases in which the canal is opened, drainage is induced to the extent that organisms are swept into the canal much as they are carried outward in the nasal discharges of the respiratory tract. This is especially true when the pulp canals and periapical areas are aspirated at short intervals. It has given us the best opportunity that we have thus far observed for determining when the infection has come to an end. Direct smears from the discharges may be made and suitably stained and these, if accompanied with suitable cultures,

rather definitely determine when one may end the treatment and fill the canals. During the coming year, we are going to attempt a classification of the newer and more nearly ideal drugs with the idea of selecting those best suited for the several conditions that arise in the management of apically involved teeth. We have been so frequently asked for a routine procedure that we hope to standardize our methods to a point where they may be of use to the operator who does not have the laboratory facilities necessary for the important details that the observer in the experimental process must necessarily resort to.

Another important classification of drugs as it effects our treatment involves knowing whether drugs may be used that will suppress such leukocytic infiltration, when negative cultures have been in evidence, without damaging effect on the vital periapical tissues. Our work has been carried far enough in this field to lead us to the belief that there are at our disposal at least a few such drugs. The operator will at once appreciate the necessity of such a change just preceding the filling operation, for unless the canals can be thoroughly desiccated, an ideal root filling by our method, and perhaps by any method, is impossible. This part of the work, including the necessary clinical observation, may require two years, but we hope to be able to standardize a method for at least the easier cases in a shorter time.

The work in the laboratories and clinics of the University of Michigan has quite definitely established an etiologic relationship between certain teeth responding to all vitality tests which prove on pulp extirpation or extraction to be in varying stages of slow degeneration. It must be obvious that if we aimed at eliminating teeth as possible foci of infection, there would be no limit to extraction. We have just as definitely proved that such etiologic relationship does exist in vital infected teeth as it has been proved that they exist in pulpless teeth. Vital pulp involvement is universal and will continue to be so as long as our patients insist on having natural teeth. It is our opinion that if we, as a profession, hope to achieve what we set out to do when the problem was thrust upon us a few years ago, we must meet this problem and solve it constructively, not destructively, by surgical measures less destructive than universal extraction, if we are to have the respect of the public that our services should demand.

DISCUSSION

George Evans, New York City: I have treated many things on experimental grounds. On pulpless teeth in the apical cavity I have been led to do ionization, with compound tincture. Dr. Jones of Atlanta, Ga., who has made extensive experiments, has shown me great results, and I have obtained similar results. Dr. Rickert has not mentioned iodin. If he has treated with it, I should like to ask what results he has got from it, by testing and experimenting afterwards, to see if there are any cultures that can be obtained.

Dr. Rickert (closing): Mrs. Hadley and I have been asked that question often. We had a case that we finished a few days ago. We could not get negative results from straight medication. Every time that we obtianed cultures and direct smears, we found the culture to be positive. With a little weaker iodin solution that Dr. Johnston uses, we obtained negative results. In my work, we are trying to simplify this operation, bringing it within the reach of dentists. Many will not take the time or go to the expense to devise an electrosterilization outfit. We have been trying to simplify that. Ionization has a number of advantages, in many ways. As far as the use of electrosterilization in the average office is concerned, few men have the equipment. We are trying to simplify it, so that every one can do it.

FORCES OF OCCLUSION AND THEIR RELATION TO OPERATIVE DENTISTRY*

By MARTIN DEWEY, D.D.S., New York City

FORCES of occlusion have been defined as those forces which cause teeth to assume and maintain a proper position in the line of occlusion. This definition might be changed to define "forces of occlusion" as those forces which cause teeth to assume and maintain a proper relation to each other and a proper relation to the face and cranium. From the standpoint of operative dentistry, we can directly consider only those forces of occlusion which have to do with maintaining teeth in their proper position, because teeth must necessarily have erupted before very much operative work can be instituted.

The two most important forces of occlusion as related to operative dentistry are the force of proximal contact and the so-called "force of the inclined plane." By "force of the inclined plane," we mean the relation of the occlusal surfaces of teeth to the occlusal surfaces of the teeth of the opposite arch. We are trying to drop the words "inclined plane" because, as Dr. Prime called to the attention several years ago, occlusal surfaces of the teeth and cusps do not possess inclined planes as defined in physics and mechanics, but present a series of curved surfaces. We now endeavor to speak of the "force of proximal contact" and the "force of occlusal surfaces."

In speaking of occlusal surfaces, it must be remembered that we consider the cusp relation of the teeth of one arch as functioning with the teeth of the opposing arch. In fact, all forces of occlusion must be considered from a functional standpoint and must be so studied in operative dentistry. For example, in doing restorative work, inserting fillings and inlays, the object is not only to repair the tooth but to so repair the defect and shape the restoration that the tooth will be able to perform its proper function after being repaired, just as it did when it possessed its natural anatomic form. In fact, the close relation between form and function must always be kept in mind in considering the forces of occlusion as related to operative dentistry. I do not think that it is necessary to go into a detailed description of tooth form; I shall simply call your attention to the relation existing between the cusp and contact point as regards function, and the effect of this function on structure. Not only does the shape of the cusp have a definite bearing on the shape of the contact surface, but also, we find, these two forces working together produce a typical jaw and face form as well as a definite temporomandibular articulation. These forces of occlusion are so positive

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that we have formulated the following anatomic laws, which hold true with all animals that have teeth, regardless of species, family or order.

The first law is: As the length of the cusp increases, the proximal contact decreases. This law also works in the opposite direction; namely, as the proximal contact increases, the length of the cusp decreases. The second law is: As the length of the cusp increases, the depth of the glenoid fossa increases. The third law is: The greatest diameter of the occlusal surfaces of the teeth is always at right angles to the greatest diameter of the condyle. As applied to the human individual, we find long cusped teeth have small proximal contacts, short cusped teeth have broader proximal contacts. The temporomandibular articulation varies in these individuals according to the laws that I have stated.

It must also be remembered that a functional wear changes the length of the cusp and also changes the shape of the proximal contact surfaces in accordance with the laws that I have stated. For example, young individuals may possess long cusped teeth and a small proximal contact point. With the long cusp, we find a deep glenoid fossa which is associated with a greater vertical mandibular movement in comparison to lateral movements. If this individual uses the teeth properly and masticates as he should, there will be compensating changes taking place which will always keep the teeth in function, not only as regards the cusp and proximal contact but also as regards the supporting structures of the teeth. As function wears the cusp so as to make it shorter, it also wears the proximal contact to make it broader. As the cusps are worn down, the proximal contacts become wider, gradually approaching the occlusal margin. In other words, the wearing down of the cusp, the occlusal surface and the proximal contact changes the shape of the tooth so as to bring the proximal contact closer to the occlusal surface. The proximal contact moves occlusally as the result of wear, changing a convex surface to a more flattened surface, and also, because the cusp becomes shorter, reducing the distance between the tip of the cusp and the cemento-enamel junction. As the cusp of the tooth becomes shorter, the occlusal surface necessarily becomes flatter and the proximal contact becomes broader. The change in tooth form also produces a change in the temporomandibular articulation whereby the glenoid fossa becomes shallower and the mandibular movements assume a greater lateral range than is found with the long cusped tooth. A compensating change also occurs in the supporting structures. The alveolar process and peridental membrane respond to these functional conditions and develop support for a particular form and definite function.

Normal cell metabolism has been named as one of the forces of occlusion. As related to operative dentistry, it must be considered as being responsible for the development of the alveolar process and the peridental membrane in response to the function of the teeth. Histologic examination reveals a great difference in the alveolar process in the mouth of the same individual, who possessed teeth of different forms and functions on the two sides of the mouth. We find function will also be greatly modified and the forces of occlusion deranged by mutilation.

Under mutilation, we consider extraction of teeth as well as caries and improper restorations. Caries which destroys the proximal surfaces of the teeth makes it necessary for the proper restora-

tion to be supplied. This restoration should not only consist of building a typical proximal contact such as would be found in the teeth at the time of eruption or which would be described as normal tooth form. If the greatest degree of function is to be obtained, proximal contact and occlusal restoration must be made in accordance with the age of the patient. They must be so constructed as to give the proper mesiodistal diameter of the teeth, and so shaped as to protect the gingiva, and must also be shaped according to the proximal contacts of the normal teeth which have not been affected by caries.

In mouths of individuals whose teeth show great occlusal wear, in which the cusps are short and the proximal contacts have been worn flat, it would be a decided mistake to make a restoration with a small round proximal contact. This mistake would also be more serious if an attempt were made to reproduce a cusp formation such as the individual possessed before functional wear had taken place. This attempt to produce typical anatomic tooth forms in mouths of individuals whose teeth show great functional wear is a serious thing. Such a restoration not only interferes with occlusion, thereby throwing an added stress on the pericemental membrane and alveolar process, but likewise interferes with the proper mandibular movement and increases the strain on the temporomandibular articulation. It is true that, in young individuals, the alveolar process and the temporomandibular articulation adjust themselves to tooth form and function. But even this development of the alveolar process in response to function occurs along histologic lines only when the individual shows normal cell metabolism or normal development. For example, in rachitic individuals, we find normal tooth forms, but instead of function producing proper development as it would in a normal individual, we find that the functional use of the teeth in rachitic individuals not only produces malocclusion, but even produces jaw deformities. The development of tissue from function occurs only when cell metabolism is normal.

In making extensive restorations in mouths in which the forces of occlusion have been greatly disturbed because of mutilation, it must be remembered that any restoration undertaken must be in accordance with the existing conditions, and the forces of occlusion must not be put out of balance.

Certain operators become engrossed with a particular technic and attempt to make restorations along certain technical lines without any consideration of the forces of occlusion involved. In individuals whose teeth show considerable wear, we find men advocating an extensive opening of the bite in the attempt to restore the mouth of a middle aged or old person to what it might have been in early life and before mutilation occurred. These operators fail to realize that they are greatly changing the environment of the individual and are throwing unusual function on the teeth and, in a few days or weeks, are bringing excessive stress to bear on the supporting tissues.

It might be true that when these restorations are mounted on an articulator and considered from a purely mechanical standpoint, they have an advantage from a masticating point of view over what the individual possessed at the time the restoration was begun. They fail to realize that this excessive restoration in opening the bite is going to throw undue stress on the supporting tissues which is going to result in one of two things:

The supporting tissue is going to respond to that function and become strengthened, and change so as to take care of this added and increased stress; or will fail to respond and break down under the increased load. This extensive restoration will also produce a changed movement in the mandible which makes it necessary for the temporomandibular articulation to adjust itself to this new restoration. It is true that the mandibular movement, the supporting tissue and the temporomandibular articulation in animals have all developed as a result of tooth form and function in accordance with a normal cell metabolism. In making these extensive restorations in aged individuals, we have little assurance that normal cell metabolism is going to respond as a result of this sudden change of form and function.

The development of the dental apparatus and the growth of the supporting structures extends over a period of many years and allows for a gradual adjustment of the supporting structures as these various changes of tooth form occur. The individual develops his deciduous teeth; they are replaced by permanent teeth, and the supporting tissue develops in accordance with the change of teeth. But it is a gradual change, which allows cell metabolism to adjust the various parts in accordance with changed function. In operative dentistry, when extensive restorations are made and the bite is open to a great degree, the change of form is so sudden that the supporting tissue breaks down under the excessive load and, instead of cell metabolism helping to develop new tissue, it becomes a factor in destroying what is present. We realize that a great many mouths are, to a certain extent, ruined by mutilation, and the patient suffers from improper mastication. It must be remembered that the majority of those individuals have passed the "crest of the wave" and are on a decline. It is therefore very foolish, from a biologic standpoint, to expect to be able to make an extensive restoration in these individuals and bring the mouth back to what it was at 20 years of age, expecting the supporting tissue to respond.

Realizing that something should be done to improve the mastication of that individual, it must be done in such a way as not to be a detriment to what remaining teeth there are. Care should be taken to make a restoration which will not make necessary an unusual jaw movement or throw excessive stress on the supporting tissues. Restorations should be made in accordance with the forces of occlusion, remembering that any one force of occlusion thrown out of balance will become a detriment and destroy all the rest that are acting properly. It is our opinion that in making restorations in accordance with the forces of occlusion, the age of the patient is a great factor and restorations should be made in accordance with tooth form and function as they existed at that time, rather than be made with the idea of carrying out a particular technic. A mechanical piece of work, beautifully done, may become a great detriment because it does not allow the teeth to function according to the forces of occlusion.

17 Park Avenue.

DISCUSSION

Abram Hoffman, Buffalo, N. Y.: The proper maintenance of tooth form and relation in the work of the operative dentist is of utmost importance. It is to be regretted that such a message as Dr. Dewey has given us comes only to a group of practitioners such as are gathered here—men whom I know to be thoughtful—men who think as they work. It is the great rank and file of operators not represented here who, in their restoration work, think only in terms of the "ideal" in

tooth form or simply in terms of a "filling." With the introduction of better cavity preparation two or three decades ago, and then with the better contour work resulting from inlay technic, there has resulted what may almost be termed a complex in the matter of tooth form restoration. Much has been written in connection with the "ideal" restoration, and I wish only to remind you that the three laws mentioned by Dr. Dewey are fundamental and must be a part of our daily work. We must not lose sight of the changes in form that take place as the result of wear, age and the health of the patient. The occlusions that have been completely upset because of faulty restorations in both morsal and approximal surfaces are legion. The detrimental results on occlusion of such work are only too well known to the orthodontist—the periodontist will remind you of the evil done the supporting tissues—to say nothing of the changes that take place in the glenoid fossa in the case of faulty prosthetic restorations, particularly in partial dentures. It should be remembered that the mutilation of tooth form and relation, from whatever cause, decreases the efficiency, and as the mutilation increases so, in proportion, does the difficulty or complexity of restoration, either through fillings or otherwise, increase. The restorations must be made in accordance with the sum total of conditions as we find them; in other words, the forces of occlusion must be observed and be kept in harmony with the general function of the structures involved. Dr. Dewey's word of caution relative to opening the bite, especially in adult cases, should be carefully considered, for his statements are logical. This practice may be followed in young individuals quite safely because of the prolonged and more active cell proliferation and nature's more ready adaptation to changed environment and function, but, even then, the characteristic morphology of the teeth and the form and function of the temporomandibular articulation must be kept in mind. Our literature has been replete with descriptions and illustrations for reproducing ideal tooth forms in the various branches of practice: the point that should be stressed is the reproduction or development of the individual normal, for this or that particular case, so that the tooth or teeth in question will function harmoniously with the dental organism as a whole.

Austin F. James, Chicago, Ill.: The ideas brought out in Dr. Dewey's paper coincide so perfectly with those of the periodontist in his efforts to prevent destruction of, or restore to a condition of health, the supporting structures of teeth that there is little to be discussed. He has called attention to the wear of cusps and contact points from normal function. I agree with his observations and conclusions, but the periodontist sees many cases of prominently marked teeth (those with long cusps and deep sulci) which show no wearing down from the normal function of masticating food, but do show flat slanting surfaces or facets on these cusps caused by constant contact with each other. High strung or nervous individuals sometimes form the habit of rubbing these cusps together; others, of gritting the teeth in sleep. Under these conditions, the cusps are not worn shorter but sharper, and act as wedges when muscle pressure is exerted in closing the jaws, this producing a wedging force, bringing about in some cases a lowered resistance of the tissue cells and in others acting with sufficient driving force to cause irritation, congestion and absorption of the alveolar process, with the inevitable formation of pockets. I have advanced this idea for some years and realize that few have agreed with my interpretation of the wear that I am attempting to describe. But I have many models that, to my mind, illustrate the point that this wear is not the result of normal function. To get back to the operative dentistry standpoint: the periodontist must have the cooperation of the dental operator in the repair of mutilated teeth, and the restoration of contact points and occlusion, as well as the replacement of lost teeth by properly constructed restorations.

FUNCTIONAL RESTORATION AS AN ELEMENT IN FACIAL REPAIR

By J. EASTMAN SHEEHAN, M. D., F. A. C. S., New York City

PERHAPS one ought to apologize for reminding a gathering of surgeons that consideration is to be given to function in any case of surgical intervention on the face. There is some excuse for doing so, however. There is a steadily increasing literature about repairs of various kinds effected in that area of high visibility, and I suppose all of us, when we glance at such articles, at once make the comparison between the first and the last photograph with little more in mind than the degree of betterment in appearance that has been attained. Gradually, we come to think that the esthetic improvement is the whole object of the procedure; so that, if we go on long enough, we are liable to fall into serious error as to the quality of the surgery that is demanded, the same error into which the general public is misled by reckless publicity and also by the actual methods of some enterprising people whose practice is little concerned either with function or with the nature of the tissues with which they have to deal.

The truth is, of course, that function and appearance are closely allied. One may say that, as a rule, failure of function either is caused by some disfigurement or itself produces disfigurement. And the converse is equally significant; restoration of function conduces to esthetic improvement, and may even, in extreme cases, go far to compensate the patient for such disfigurement as may remain after all possible has been done.

This leads to another consideration. It is axiomatic that any condition of the kind we have here in mind is to be diagnosed in terms of the loss, whether that loss affects tissues or function. But there is more: there may be loss that is intangible without being, on that account, any less real. Facial disfigurement may carry with it loss of the means to make a living; not because the capacity has been lost but because there is an unwillingness to afford to the victims the opportunity to work under the view of others. They may be capable of service, but they are ineligible for employment. Or, again, the person so disfigured may be so self-conscious as to shrink from all normal social contacts, or may be shunned by those whose society would be agreeable. Loss of the prospect of marriage, which is no small matter to some persons, may be occasioned by what, from the surgeon's point of view, might be considered a very minor disfigurement. The face brings into the problem the relation of the individual to society, and while that is not commonly thought of as being within the range of surgical concern, actually it is.

Evidently, therefore, everything within the arsenal of reparative surgery is to be drawn on, according to the need, with a view primarily to the restoration of

function, and the resulting stimulus to ingenuity is one of the things that imports an element of fascinating interest into the handling of every case of this nature.

Let me indicate the variety of these expedients by citing a few instances.

Customarily, we think of blockage of the airways as the only interference with function in relation to the outer nose, and, in the same way, we think of the septum as the seat of the dysfunction. But there are certain distortions of the columella which materially impede inspiration, and anything that lessens the flexibility of the muscles about the nostrils also constitutes a serious impediment. Traumatic injury frequently so flattens the nasal bones that there must be an alteration in the nature of the posterior channels. As one studies the variety of injuries resulting from a heavy blow on the nose, he comes to see that the best expectation of restoring normal function, not merely the partial function associated with the passages nearest the septum, is to be realized by restoring all the elements of the outer nose as nearly as possible to the normal position. So there is an advantage in separating the nasal bones at the maxillae and raising them to the old level, as also in reducing the size of hypertrophied lower lateral cartilages. It is a fortuitous coincidence that the excised portions of the alar cartilage serve very nicely to prolong the new line of the dorsum established in the upper quadrant by raising and realining the nasal bones. There is undoubted satisfaction in observing the gradual reconstitution of the nose as the septum, columella and tip are restored by simple expedients, but there is still greater satisfaction in knowing that the better the nose looks after these readjustments, the better the functional restoration.

Or suppose we consider the conditions in the orbit from which, in whatever manner, the eye has been removed. In the normal state, the eyelids are ensured freedom of action by the flexibility of the conjunctival membranes. Destruction of these results in adhesion between the elements within and without the orbit, and as long as that condition persists, there cannot be even a semblance of function as regards the lids. But once an epidermic graft, properly cut and properly placed, has been substituted for the conjunctival sac, the lids can be made to regain their mobility. If the nerves of the lids have been conserved, as very often they can be, the lids, after any number of devices for repair have been completed, may function almost as well over a prosthesis as they did over the eye itself. That account may sound like a commonplace of the clinic, but, for the patient, there is the additional interest that he is no longer refused employment because of his repulsive appearance.

In this region of the orbit, there are two conditions nowadays encountered with rather disturbing frequency. One is the typical windshield wound, the other, the typical knife wound resulting from the antagonisms of certain city groups having old world traditions. In both instances, vertical incision of the strands of the orbicularis muscle conduces to lagophthalmus, as well as producing disfigurement. A delicate plastic procedure indeed is the regrouping of the muscle strands across these wounds; but once that is done and the skin cover is returned, both the functional and the esthetic restoration have been achieved.

Perhaps it may be interesting to note some other instances in which the desire

at least to simulate function has led to some manipulation of muscle elements. One patient had suffered loss of all the tissues from and including the angle of the mouth to well outward toward the ear. We succeeded in covering that defect by a double skin-flap, one for lining and the other for cover. Joining the lips in that way left much to be desired from the point of view of mouth function. This was partly remedied by manipulation of the muscles of the upper and lower lip, giving a pretty fair balance at that buccal angle for the action of the muscles constituting the orbicularis oris at the other angle. Unlike the orbital orbicularis, which is an independent muscle, the orbicularis oris is largely made up of the terminal strands of other muscles, so that, by utilizing these other muscles, its mechanism can be rather closely simulated. In the case mentioned, this principle was extended a little further, strands of muscle carried down between the inner and the outer skin of the face cover conferring some resiliency on that part.

In another of these cases, involving, this time, almost the whole of one side of the face, the skin cover was given support by insertion of bands of fascia which, being attached superiorly to the temporal muscle, not only served as a stay to the inert skin tissues but also, as the action of the muscle influenced the fascia, effectively simulated muscle movements on the cheek.

Another interesting application of the tensile and resilient properties of fascia relates to the correction of some of the consequences of unilateral paralysis of the facial nerve. Since the living muscles on one side of the mouth are deprived of the normal antagonism by which symmetry is established and maintained, distortion follows, with some degree of dysfunction. What is required is to overcome the antagonism, and this can be done, with considerable effectiveness, by means of fascia bands carried to locations near the mouth and then drawn up and anchored in the tissues forward of the ear. It is the restoration of something like a functional balance that underlies the esthetic correction in these cases.

In most of these instances, concern for function is to a greater or less degree incidental. But where, for example, the state of the tissues has produced intractable or even permanent trismus, restoration of function becomes the first of all concerns. The condition is produced by scarred and contracted membrane oftener than might be thought, and the flexibility of the membrane is impaired, it is useful to note, not only by disease but often by the devitalizing effects of the ray or radium treatments by which it is sought to check the disease. One finds, for example, after many such treatments of an angioma, that all the tissues about the growth have been rendered incapable of functioning, only the tumor itself remaining indifferent to the repeated attacks. Extirpation of the tumor is necessarily accompanied by excision of all the useless membrane, and its replacement, after relief of the trismus, by some material which will not again act to immobolize the jaw. This is another of the many emergencies in which recourse may be had, with all confidence, to the epidermic graft. In practice, there is no area too large for it to cover and there is almost no surface on which it will not "take." Sometimes, it may be necessary to keep it stretched for a time, to obviate the possibility of shrinking and the effects of shrinking that can be foreseen, but the time is well spent.

It is hardly necessary to enlarge on the interference with function that is involved in the presence of contractile scar, whether produced by burns or by other injuries. Obviously, it limits by its presence the functional action of the tissues it overlays, and that action can be restored only when the tissues are given a covering under which they can freely move. Here, we enter the field of skin grafts in general, epidermic, free full-thickness, tubed pedicle and all the other variants. It is a field where experience and skill are demanded, and where the esthetics of the end result are of almost paramount importance. The patient whose face is to be exposed to the merciless gaze of society is entitled to the best that can be done for him.

We may leave that phase of the subject with the remark that, unless due regard is had for function, the esthetic betterment will not materialize, or will not be permanent; whereas, if function is safeguarded, improvement of appearance is vastly facilitated.

And may I conclude by suggesting that practitioners of one and another branch of physiotherapy might do well to give a little more thought than perhaps some of them do give to the probable consequences of devitalizing the tissues with which they have to deal. With the consequences of disease and accident, we must expect always to have to deal, but there is surely a momentous significance in the fact that plastic or reconstructive surgery now has to cope with a great variety of dysfunctions and disfigurements that originate in this field of therapeutics.

TREATMENT FOLLOWING THE REMOVAL OF THE IMPACTED MANDIBULAR THIRD MOLAR*

By GEORGE C. FAHY, D.D.S., New Haven, Connecticut

THE subject of postoperative care in cases of removal of the impacted mandibular third molar is most apropos after the presentation of Dr. Winter's original work in its classification and the technic of removal, in that it had its inception from this phase of the work. Previous to the working out of this technic, many of our patients were experiencing serious postoperative results.

Dr. Tholen, of Los Angeles, has summed up the situation thus:

The seriousness of the operative treatment is underrated and the treatment often results in traumatic lesions more serious to the patient than that associated with the original impaction.

While the profession as a whole was building up elaborate schemes for postoperative treatment, Winter attacked and solved the cause of our troubles, which, as you know, is, in most cases, trauma. All new methods submitted to dentistry and medicine are received by the professions with skepticism. This, I believe, is most commendable, as it protects our patients from the many new ideas which are, in most instances, short lived and capable of doing more harm

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Sixty-Ninth Annual Session of the American Dental Association, Detroit, Mich., Oct. 24, 1927.

than good. There comes a time, however, when we are doing an injustice to the people who fall into our hands by not accepting a technic which has proved by the end results in thousands of cases its ability to reduce trauma to an almost negligible quantity, to minimize suffering and to conserve tissue.

Postoperative results, good or bad, are essentially preoperative problems, and we will succeed in making our postoperative difficulties negligible directly in proportion to the correctness with which we have made our preoperative interpretation. I should like at this time to make one point clear, and that is that there are cases, even though they are in the hands of men thoroughly familiar and experienced in this technic, in which we have and will continue to have postoperative trouble. Dr. Winter has given us the operative technic; Dr. Rounds has furnished roentgen-ray interpretation. There are, however, other factors that enter into the final result: (1) age; (2) resistance; (3) infection; (4) bone spiculae; (5) fractured lingual plate; (6) rough edges; (7) failure to eradicate septum; (8) foreign bodies in socket, and (9) exposed osseous structure.

It is not advisable to operate in the presence of infection, and although there are cases in which it becomes necessary to do so in order to establish drainage, they are infrequent. Many men do operate in these cases regardless of the infection present, obtaining, in many instances, a normal recovery. To my mind, the conservative method of clearing up the cases before operating is preferable.

Granting that the operator is successful in the majority of his cases, in which the operation is performed in the presence of infection, obtaining a normal recovery, it is my contention that the suffering of patients who do not react favorably is sufficient justification for adhering to the conservative method. It is well to bear in mind that the mandibular third molar is distinctly individualistic in many respects: (1) time of eruption; (2) varied positions assumed in the arch and the mandible; (3) frequent association of infection with its eruption; (4) its effect on the adjacent second molar; (5) as a causative factor in periodontoclasia; (6) its effect on the arch as a whole; (7) the part it played in disrupting the results obtained by the orthodontist, and (8) its peculiar and interesting lymphatic drainage.

The removal of this third molar is bone surgery, and there is one irrefutable axiom that must be honored in all of our cases, and that is that we must keep our fingers out of the wound. Failure to do this has been the cause of many disastrous end results, though all the other factors leading to a successful termination have been observed. The cases with which we have the most difficulty are the semi-eruptive types with an associated flap and where there are no manifestations of inflammation or infection. The usual procedure is to operate in these cases immediately, with the feeling that there will be no unusual postoperative trouble.

Frequently, these patients return forty-eight hours after operation complaining of intense pain and general discomfort. My observation has been that it is due to infection under this flap which is dormant at the time of operation but is made active by our surgical intervention. The only way I know of to avoid this contingency is to treat all cases in which there is a flap present in the same way that we would treat a case which presented clinical manifestations of active infection. In removing this flap, as in many cases is advisable, better results have been obtained by the use of

the actual cautery than with the knife. In treating these infections, we have had success with the use of methylene blue powder. The part is first thoroughly irrigated with a sodium-borate sodium-chlorid solution, then dried and packed off. The lips and chin are smeared with "K-Y" to prevent discoloration of the skin. Three or four treatments on successive days will usually clear up the case.

There is more or less pain following the removal of this tooth, and this we should anticipate. It is advisable in all cases to administer some internal sedative directly after the operation, such as a combination of acetyl salicylic acid (aspirin), phenacetin and caffein, codein or any other drug that may be indicated. The employment of ice is an important factor, and the best results are obtained by application immediately after the operation. It should be used with caution, since its use over a continued period will cause pain of another character, which is, in many cases, more severe than that associated with the original lesion.

Consistently good results have been obtained by using ice in alternate periods of five minutes for the first half hour after the removal of this tooth, this treatment to be continued by the patient for four hours after returning home. The application should be confined to the first half of each hour in alternate five-minute intervals, with a rest period of a half hour in each hour. The use of ice tends to reduce hyperemia and inhibit bacterial activity.

Thorough examination of the socket after operation and recognition and elimination of the conditions which may be factors in causing postoperative discomfort are of the utmost importance. Among these factors are the presence of (1) loose spiculae of bone; (2) foreign bodies; (3) fractured lingual plate; (4) unprotected or rough margins; (5) fractured septums, and (6) soft tissues which may degenerate.

Spiculae of bone and foreign bodies should be removed; also, the lingual plate and septum if fractured, rough margins and unprotected osseous structure should be trimmed down to a point where they are covered with tissue. Soft tissue which may subsequently degenerate should be cut away.

A dry socket constitutes a circumscribed osteomyelitis, due in most cases to subacute infection and trauma. If the resistance of the surrounding tissue were not high, we would have a general osteomyelitis. This is an important point to have in mind because of the treatment which is used. The socket should be thoroughly cleaned and lightly curetted, sufficiently only to cause bleeding. Great care should be taken to avoid breaking through the wall of the socket and bringing about osteomyelitis of a diffused type. This procedure will, in most instances, have to be repeated several times, When infection has been dissipated, we will have a normal clot formation. Intense pain is usually associated with this condition and the use of a local sedative treatment is indicated. There are many effective remedies. We have had uniformly good results with the use of orthoform and acetyl salicylic acid in equal parts, with mineral oil as a vehicle. General medication is used when indicated. If a case does not clear up within a reasonable period, it is advisable to have a urinalysis, as, in cases of diabetes, we have, following extraction, a condition simulating clinically in many respects a dry socket. This can readily be accounted for, as diabetes is a disease of the trophic nerves.

Trismus is due to infection and trauma. We have an infiltration of serum into the muscular tissue, which prevents muscle stretching. The absence of tris-

mus is particularly noticeable where the deflection is lingual. It is quite possible that this is due to its lymphatic involvement. The drainage, as you know, is on the lingual side and through the same duct as that which drains the tonsils. Avoid, where possible, the forceful opening of the mouth in the presence of trismus, as it will result in a tearing of muscular tissue, or, in case the posterior teeth are missing, a possible fracture.

There are many mouth washes on the market. My experience has been that most of them are prepared with but two objects in view: to look good and to taste good. For a wash to be used after the extraction of teeth, I know of nothing better than a sodium chlorid and sodium borate combination, 3 parts by weight of sodium chlorid to 1 part of sodium borate. Flavor of any sort may be added to suit the prescriber.

CONCLUSION

1. Avoid trauma.
2. Clear up infection before operating.
3. Keep the fingers out of the socket.
4. Use gentle irrigation rather than force in washing out sockets.
5. Avoid, where possible, medication of the socket.
6. Always use sharp cutting instruments.
7. As a routine, use internal sedatives in all cases.
8. Remember that the reduction of temperature by the use of ice is important and that the best results are obtained by using it intermittently.
9. Bear in mind that the mandibular molar is more or less of a distinct entity and must be handled accordingly.

DISCUSSION

J. L. Loftus, Meriden, Conn.: I wish to ask Dr. Rounds† about medication to prevent trauma after the removal of an impacted tooth. Are you advised not to use any at all? Supposing there was no flap infection or that we cleared it up before the operation. Do you consider it better not to pack that wound?

Dr. Rounds: Any questions as to Dr. Fahy's paper, I shall have to answer as *per* myself. I wish a normal clot formation as soon as possible, and I leave it alone as much as possible.

E. Krieger, Baltimore, Md.: Are not dry sockets, most of the time, due to the use of epinephrin? I have found a number of patients who are susceptible to epinephrin, and, in the absence of trauma, they still have dry sockets.

Dr. Rounds: I find that dry sockets are due to many things. I think that the use of an excessive amount of epinephrin would have a tendency to suspend circulation at the time, and we do not get the immediate blood flow which we would get without it. I may answer the question better by saying that the sooner we get the blood clot, the better, regardless of the anesthetic agent.

A. E. Maun, Findlay, Ohio: In how many of these cases of impaction, do you pack with gauze?

Dr. Rounds: In an infected case, we wish to have the normal blood clot develop as soon as possible. In cases of separation, necessarily we pack.

C. B. Coleman, Poplar Bluffs, Mo.: What preoperative course is followed in preparing an aseptic field? In general surgery, of course, that is the most important factor in preventing postoperative distress. Now, in the average office, we pay little attention to preparing an aseptic field in which to operate. Many times, the patient sits in the chair for five minutes for the first time, and, in five minutes, the teeth have been removed with no preliminary preparation from the standpoint of asepsis. I think that an aseptic technic should be followed in all of our operations. Should not this be routine? I mean by preparing the field not only in the region of the mandibular third molar on which we contemplate operating, but the entire oral cavity. Stress was laid a while ago on avoiding the flow of oral secretions into the wound. Secretions from the nose and from the sinuses, and, in many instances, the condition of the digestive tract as a whole, I

†The paper of Dr. Fahy was read by Frank W. Rounds, Boston, Mass., in the absence of the author.

think, should be given more consideration than is our wont. I should like to inquire as to whether that is a part of the usual procedure before operation.

Dr. Rounds: It goes without saying that the better the physical condition of the patient, and the better the sanitary conditions in the mouth, the better the results should be. From the standpoint of operating, as Dr. Fahy remarked, if the continuity of the mucous membrane has been broken in any way, it is a safter procedure, even if not particularly indicated in the individual case, to keep that case under observation under the treatment which he indicated and to take care of it as though it were an actively infected case. As far as the actual preparation of the field is concerned, in my practice the area is cleansed mechanically, and the field is painted and absolutely walled off by large cotton sponges, which at the same time act as a throat pack during anesthesia, so there is no chance for saliva, or other secretions to get to that area until the blood clot has filled it up. Dr. Coleman is right in emphasizing that a clean mouth gives us a better chance to lessen the trouble that might result, and the better the physical condition of the patient, the better for us in the majority of cases.

J. Mackay, Waukegan, Ill.: We are supposed to clear up infection before operating. Suppose we have a partially erupted tooth, and the patient is having peritonitis and partial trismus, the infection lasting for weeks without clearing up. Is there any method by which that infection can be cleared up before operation?

Dr. Rounds: A treatment for that case was indicated by Dr. Fahy. Some cases are stubborn, but we wouldn't attempt to operate in those cases until the infection was cleared up, unless it was necessary to operate.

A question was asked about sedatives. We uniformly prescribe internal sedatives. Those Dr. Fahy indicated were acetyl salicylic acid (aspirin), phenacetin and cocain combinations; whatever seems to be indicated by the severity of the case. I usually administer internal sedatives immediately.

Dr. Mackay: Do you advise use of a cathartic before the operation?

Dr. Rounds: It is perfectly logical that the bowels should be open, but unless there is some special reason, I see no indication for a cathartic.

R. T. Somers, Norfolk, Va.: What is the most practical method for preventing saliva coming into the wound in the operation for the impacted third molar?

Dr. Rounds: My method is to use a large cotton pad, about 4 inches square and half an inch thick and varied according to the size of the mouth. This is used for three purposes: (1) to wall off the field and keep the saliva away; (2) to prevent any atmospheric oxygen coming into the field and diluting the gas mixture; (3) to catch any débris, spicules or anything that might escape into the throat. I find that adequate in protecting the field from saliva.

Dr. Somers: Do you use the same method in local anesthesia?

Dr. Rounds: I would use that on the lingual, and, if necessary, on the medial aspect. I would use whatever was indicated to prevent saliva getting into the area of operation.

FOREIGN BODIES OF DENTAL ORIGIN IN THE AIR PASSAGES

By LOUIS GINSBURG, B. S., M. D., Toledo, Ohio

THERE are two sources from which foreign bodies of dental origin in the air passages arise: (1) accidental detachment of dentures or other dental appliances while worn by the patient; (2) mishaps during oral or dental operations or manipulations.

When the great amount of dental surgery being done is contrasted with the small number of dental objects aspirated, the dental profession is to be commended for its excellent surgical technic.

Etiology.—Such bodies may be aspirated during sleep or while the patient is unconscious or under an anesthetic. A few cases have occurred during local anesthesia, owing to the abolition of the pharyngeal and laryngeal reflexes. Artificial dentures and appliances may be loosened while eating, and swallowed. The foreign body may be aspirated during laughter or an attack of coughing.

Kinds of Foreign Bodies.—The bodies of dental origin are dentures, natural and artificial teeth, fillings, crowns, bridges, broaches, burs, clips, springs, hypodermic needles, pieces of instruments, atomizer tips, applicators, cement, plaster and cotton or gauze sponges.

Site of Lodgement.—Foreign bodies may become lodged in the larynx or the trachea, but most of them pass down into the bronchi. Most of these bodies are located in the right lung. The reason for this is that the right bronchus is a continuation of the trachea and is almost in a direct line with it, while the left bronchus deviates considerably from the tracheal axis. The right bronchus is larger in diameter than the left and there is a larger volume of air drawn into the right lung. In Gill's statistics, the ratio was 2 to 1.

Prophylaxis.—Most dental surgeons are careful to prevent aspiration of foreign bodies during operations. This objective is reached by packing with cotton or gauze during extractions or the use of a rubber dam when placing fillings or crowns. After the completion of an extraction, there should be a strict accounting for all teeth or parts of teeth, roots and fillings, similar to the counting of sponges after an abdominal operation. Anything loose in the mouth should be removed before an anesthetic is given. A mouth gag may detach a loose temporary tooth in a child, and, in an adult, a tooth may be broken or a filling loosened. To forestall the accident of a dental broach's being lost in the throat, a piece of thread should be tied to it. Patients should be cautioned not to neglect loose fillings, crowns and dentures. Removable dentures should be taken out of the mouth before retiring or even when one is taking a nap.

Symptomatology.—A foreign body in the larynx, if it does not produce obstruction and immediate asphyxia, causes laryngospasm, followed by croupy cough

and wheezy respiration. There may be a symptomless period, if the foreign body is small.

Foreign bodies in the trachea are usually movable, and violent cough is excited by their movements. Audible slap, palpatory thud and asthmatoid wheeze are pathognomonic. Hoarseness, dyspnea and cyanosis are often present.

With a bronchial foreign body, the most constant and definite early symptom is cough. This is of varying intensity and persistence and is accompanied in some cases by dyspnea, cyanosis, wheezy respiration, pain in the chest and nausea. In a few cases, immediate symptoms are absent. The late symptoms, which simulate pulmonary tuberculosis, are cough, usually with purulent sputum, hemoptysis and pain in the chest. The onset may be gradual, or there may be a latent period of varying length.

Diagnosis.—In the case of a suspected foreign body in the air passages, the history of the case is of first importance. If the operator knows that an object has passed down the pharynx and the patient immediately develops symptoms of bronchial irritation, the diagnosis is obvious. If not, then a careful inspection of the nasopharynx, pharynx, and larynx should be made with a mirror. An examination by roentgen-ray is indispensable, and a positive plate establishes the diagnosis as to both the presence and the location of the foreign body. A negative roentgenogram is not conclusive, and, in the presence of a diffuse shadow from pulmonary suppuration, is of doubtful value. If the roentgen-ray examination is not conclusive, diagnostic bronchoscopy should be carried out, the operator being prepared to remove the body if it is located.

Prognosis.—Jackson says:

> In a general way, it may be stated that, if unremoved, foreign bodies in the trachea, bronchi and esophagus ultimately prove fatal. About 2 to 4 per cent of bronchial foreign bodies are coughed up. About 99 per cent of foreign bodies in the lung can be bronchoscopically removed through the mouth. After bronchoscopic removal of foreign bodies in the bronchi, the patients get well in about 98 per cent of the cases, even after the foreign body has set up extensive pathologic changes from prolonged sojourn. This is in marked contrast to lung suppuration of other etiology.

Sequelae.—If the presence of a foreign body has not been known nor expectant treatment instituted, the consequence may be pneumonia, abcess, bronchiectasis, tuberculosis or gangrene. Even if these conditions do not kill the patient, bronchoscopy becomes much more difficult as time goes on.

Treatment.—The foreign body can, in most cases, be removed from the air passages by bronchoscopy. The patient should not be encouraged to cough or hawk up, as this act will only force the point of a sharp object deeper into the mucosa, and, in the case of a large loose object, it may force it into the glottis and so produce asphyxia. Bronchoscopy is less difficult early in the case. If neglected, the foreign body works downward and the swelling of the mucosa obscures it. Later, granulations form and finally stricture may hide it. Waiting for spontaneous expulsion is dangerous.

Following is the report of a case of a gold bridge recovered by bronchoscopy from the inferior lobe of the right lung.

REPORT OF CASE

History.—A man, white, aged 46, whose chief complaint was cough and pain in the chest, gave a history of chronic cough for many years. About 3 weeks before he was admitted to the hospital, the cough became persistent and severe. A short time before

this change took place, the patient was awakened one night by a violent fit of coughing. He felt that some object was in his throat. As soon as he was conscious of this, he sat up in bed and made an attempt to extract the body with his finger, but failed. He thought, therefore, that he had swallowed it. The following day, the patient observed that a gold bridge which had been loose for some time was gone.

After this incident, the patient had some pain and a sense of heaviness in his chest. He consulted a physician, who told him that he had probably swallowed the bridge.

The patient became worse. The cough and pain in the chest persisted and was augmented by fever and fetid expectoration. At this point, he was referred to Dr. Salzman. Considering the history of the case and the examination of the chest, the conclusion was reached that this was a case of foreign body in the lung.

Examination.—The patient was admitted to the St. Vincent's Hospital, Jan. 3, 1927. While he was there, the temperature fluctuated between 99 and 103 F. The white cell count was 20,000. The roentgenologist reported the presence of "an opaque foreign body in the main bronchus of the lower lobe of the right lung."

Operation.—The morning of January 7, bronchoscopy was performed, under local anesthesia. The foreign body was located in the inferior lobe bronchus of the right lung and was extracted after the purulent secretion surrounding it was removed by aspiration.

Outcome.—The day after the operation, the temperature fell to 97.2 F., a drop of nearly 6 degrees. The clinician's notes on the same day read: "Condition 24 hours after recovery of the foreign body is good. The character of the sputum has changed and is white and frothy. There is no odor to it and it is reduced in quantity."

CONCLUSIONS

1. A variety of objects of dental origin have been encountered as foreign bodies in the air passages.

2. Any object disappearing from the mouth during an oral surgical procedure should not be assumed to be swallowed, but rather to be aspirated, until the contrary is proved.

3. All dentures should be kept in good repair and properly fitted. The mouth should be carefully inspected for dentures, loose teeth and any loose corrective appliance before a general anethetic is administered.

4. The most constant and characteristic immediate symptoms are cough, dyspnea, wheezy respiration and pain in the chest. The late symptoms are those of pulmonary suppuration or tuberculosis.

5. Diagnosis of a foreign body is made on the history, physical examination of the chest, roentgen-ray examination and, in doubtful cases, by bronchoscopy.

6. Bronchoscopy for diagnosis is indicated in any early doubtful case.

7. Prolonged sojourn of a foreign body in a bronchus produces serious damage to the lung.

8. Expectant treatment is always hazardous, and lung infection may develop from which the patient may die.

9. Skilfully performed bronchoscopy is a safe procedure.

616 Toledo Medical Building.

AN INTERESTING CASE OF IMPACTION OF A RIGHT UPPER CUSPID

By T. J. GEREN, D.D.S., Groesbeck, Texas

THIS is an unusual and important case to both the medical and the dental profession. A history of the case follows:

REPORT OF CASE

History.—Mr. B., an auditor, aged 46, was referred to me for examination, in July, 1923. In 1915, the patient suffered a nervous breakdown, and on the advice of his physician, he took a rest at Battle Creek, Mich. Since that time, he had suffered from vertigo. He would become cold; the pulse would drop rapidly from 72 to 40, and he would have to sit or lie down. This condition would last from one to two hours, during which time the patient was unable to walk unassisted. These attacks occurred three or four times a month. In 1922, the patient lost consciousness, and fell. Consciousness returned in a short time. When sneezing, he experienced an involuntary reflex action that caused the head to jerk back slightly. Also, at times, he felt as if there were a great weight pressing on top of the head. This was followed by nervousness. His condition caused the patient much anxiety. A Wassermann test was negative. His physician diagnosed the case as heart-block and optical vertigo.

Examination.—He had worn glasses for a number of years and was deaf in the right ear. He had had the right central and lateral incisors extracted on account of soreness, and replaced them with a bridge. The first bicuspid had moved forward and had taken the place of the cuspid. He had never suffered any pain or soreness from the impacted tooth and, in fact, did not know that the cuspid was missing, as he had never been informed of the deficiency. Radiograms were made to locate the missing cuspid, and it was found to be under the right sinus, deep in the maxilla, about 12 mm. from the gum line and 12 mm. deep under the right nostril.

Operation.—The tooth was removed, surgically, under conduction and infiltration anesthesia, Dec. 2, 1923. The root had a right angle curve resting in the sinus. The crown lay lingually to the central root. The tooth was 1¼ inches long. The patient recovered rapidly, with immediate relief.

Outcome.—Since removal of the tooth, the patient has had no vertigo, and his nervous condition has improved wonderfully. He has gained 20 pounds in weight in ninety days, and all other symptoms of which he complained have been entirely eliminated.

On its removal, the tooth showed an etched enamel and root. This was caused undoubtedly by absorption, and undue pressure from this tooth was responsible for his condition.

I have removed several impacted teeth from patients ranging in age from 25 to 77 years. In every case, there was absorption, and each patient recovered from his respective deficiency.

From my experience in the practice of dentistry, I am of the opinion that every impacted tooth sooner or later becomes a source of infection, and the reflex action on the nervous system is the cause of many maladies.

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Editorial

THE ONE THING NEEDFUL

Of course, there are more things than one needed in dentistry today. There is need for greater systematization of our technical procedures, whereby much waste of time and energy is avoided. We are wont to pride ourselves on the technical skill of our profession, but the rank and file of our members are lacking in that finesse of manipulation which makes for the most expeditious and effective performance of our daily tasks at the chair and bench. Most operators fumble too much—few of them make every move count.

There is need for better agreement in many of our theories; for instance, there is the discussion over the relative value of fixed and removable bridgework. (Incidentally, it may be remarked that there are indications for each method under varying conditions, with no hidebound rule for all cases.) There is need for still further study of our educational methods, to the end that students may

be prepared to care for the needs of the people without so heavy an investment in dental education that they are compelled to charge fees at the outset that drive away many of the people who most need their service; in other words, we must prepare graduates to care for the poor as well as for the rich. With the present trend in professional education, this is a very serious problem, and the danger is that we shall admit into our ranks only such men as are inclined to cater to the elect, and who disregard, with more or less arrogance, the necessity of caring for those in moderate circumstances. The time may come when our legislative bodies shall rise up in their might and demand that proper provision be made for the care of all classes of society, and if the methods of the day do not meet that demand, our legislators will let down the bars as they have done in some instances in medicine and admit a class of practitioners who are anything but a credit to a profession. More might be said on this subject but, for the present, "that is another story."

In that perennial topic, the pulpless tooth, there is assuredly need of a better understanding and a more uniform opinion on the part of members of our profession, and there is an insistent need of better cooperation between physicians and dentists in the management of these cases. The people have suffered great harm and much injustice through the confusion which has existed in connection with this subject, and the varying opinions which have been given them have not contributed to their confidence in either profession. Greater sanity seems to be entering into the situation, but there is still much room for the harmonizing of theories.

With all the splendid work that has been done in the field of full dentures, it is well within the mark to state that there is still need of greater unanimity of opinion among the leaders of this group. There should be worked out some system whereby the general practitioner who is compelled to do a certain amount of this work should have a more intelligent basis on which to proceed.

There are other needs in the profession which, for some time to come, will call for application on the part of our members, each in its own special way demanding a certain devotion for its solu-

tion; but the most crying need of all is one which has to do not with the solution of some scientific or technical problem or with some theory of practice, but which goes deeper into the fundamentals of our existence and has to do with our ethical and moral obligations to our fellow man. The one thing needful in professional life is integrity of purpose and rock-ribbed honesty. It is that attitude toward the patient which protects him from any kind of imposition or injustice of a professional nature. The helplessness of a patient in the hands of a professional man should so appeal to the latter as to draw out the noblest sentiments of his nature, and constitute him a real guardian of the professional rights of the patient. The conservation of the patient's welfare should be the first consideration of the dentist, and he should not be stampeded from this high purpose by the subtle influence of selfishness. To him, it is given to stand between the patient and any harm of a professional nature. That is the moral obligation placed on him the moment he holds out his hand for his diploma on commencement day. A higher essence of duty devolves on the professional man than on the business man: the latter is dealing in commodities, while the former is dealing in human beings.

It becomes, therefore, a sacred matter between the dentist and his patient, and there should grow up in the consciousness of every practitioner a conviction of this phase of his function as a professional man. Under such conditions as these, a patient should be as safe in the hands of a dentist as the limitations of human intelligence will permit. No one is infallible in judgment, and least of all a professional man when confronted with some of the dilemmas and exigencies of obscure conditions. No one can complain when errors of judgment are made, provided honesty of conviction is the impelling force of every act. But what shall be said of the professional man who uses his superior knowledge for the purpose of exploiting the patient and taking advantage of his ignorance? It is in this connection that the greatest sins of professional life are committed, and the greatest reflection is made on professional men.

There are many avenues through which exploitation may be

practiced, but no matter what guise it takes, it is pernicious in the extreme, and unworthy of any professional man. Probably the worst phase of exploitation is that which preys on the fear of the patient by magnifying the nature of his ailment and thereby exacting a large fee for an ordinary service. To exclaim to an excitable patient that he has a bad case of pyorrhea when the utmost of his ailment is a mere temporary gingivitis is only in line with much of the deception that is being practiced today, and a procedure of this kind is demoralizing to all concerned.

It is not here intended to arraign the profession as a whole, but the simple fact is apparent that there is altogether too much deception being practiced by certain men and the better element of the profession must take a firm stand against it.

The one thing needful in professional life is basic and elemental honesty. With this, the respect of the people for professional men will increase till they are looked up to as men and women of superior status; without it, the profession will deteriorate and become degraded till the name of a professional man shall be known only as anathema. It is up to dentists to make their profession what they will; the question is, what will be their choice in the matter?

ATTEND YOUR MEETINGS

Your membership in a dental society will never net you its full returns unless you attend the meetings. Habit is a large factor in this as in every other activity of life. Some men get in the habit of missing meetings and the habit grows. The less a man attends meetings the less inclination he has to attend. The more he goes the more he wants to, and the more pleasure and benefit he gets out of it. Belonging to a society and never attending is like owning a fine musical instrument and never playing it. The opportunity is there, but an opportunity must be seized in order to be of any practical value. The best part of society affiliation is the personal contact with one's fellow practitioners—the hand clasp, the light in the eye, the smile, the interlocked arms, the familiar voice and the hearty laugh. The printed page can never take the place of all of this—it is lacking in inspiration.

Habit is the great factor in society attendance. Get the habit.

C. EDMUND KELLS, D.D.S.
(1856-1928)

C. EDMUND KELLS, D. D. S.

(1856-1928)

The pen trembles as it writes that "Eddie" Kells is dead. Just as we go to press, word comes that, on May 7, this great and noble soul, wearied with the burden of his years of suffering, laid down his load and passed to the great beyond. If ever there was a martyr to science, Eddie Kells was one. He was a pioneer in the use of the roentgen-ray for dental purposes and he paid the penalty with his life. Ignorant of the dangers, as were all men at the time, he exposed himself needlessly, and the deadly ray left its indelible mark. Amputation after amputation came in succession; first a finger, then the left hand, then part of the arm, then the entire arm, then the glands, etc., etc., in a desperate struggle to stem the tide. In all, before his death, he submitted to forty-nine operations. Radium was resorted to, and every known agency was enlisted to save this precious life. Because life was precious to Eddie Kells, and his particular life was especially precious to his family and friends. No man was ever better beloved than was Eddie Kells. He drew men to him by the magnetism of his mind and heart, and by the lovable nature of his character.

And he was brave beyond belief. In the untold suffering through which he passed, he preserved the perfect poise of his equanimity and cheer. There was not in his writings—and he wrote more than most men—the slightest hint of the terrible calamity that had befallen him. His point of view radiated a brightness that makes one marvel, knowing the facts as they were. He labored to the very last that his profession and the world might be benefited by his fertile, prescient mind, and no one in the profession filled his years more fruitfully than did Dr. Kells.

It was the privilege of the Editor of THE JOURNAL to visit Eddie Kells in his home in New Orleans about two weeks before his death. There never was a pilgrimage made to any shrine with greater anticipation, pleasure or reverence than the one which took the Editor to the Mecca of this brave and gentle man. The hours spent with him in those days will linger as a loving memory as long as life shall last. The heart to heart confidences, the intimacies of a deep and personal nature, the outpouring of a fervent, tense, heroic soul all combined to make the moments very precious, and if there was ever bestowed on an individual a real benediction, it came to the Editor on that occasion.

No one can sum up the qualities of Eddie Kells in a brief article. He had so many of the major virtues and so few of the minor faults, that his character was wellnigh perfect. Whether as dentist, citizen, neighbor, husband, father or friend, he measured up to the highest and best in our common humanity, and if the aggregate of all the good he did could be known, it would make a monument greater and more lasting than anything built of marble, bronze or granite.

Enshrined in the memory of his myriad friends his fame shall last through all the days when are written the records of noble deeds and unselfish devotion to duty. Eddie Kells sweetened and sanctified the lives of those with whom he came in contact, and the world is a better place because he lived and labored in it.

BUREAU OF DENTAL HEALTH EDUCATION

TENDENCIES IN HEALTH EDUCATION*

By FRANK L. RECTOR,† B. S., M. D., Chicago, Ill.

WHEN the average person approaching middle life thinks of health education, there rises before him the memory of a textbook on physiology in which the various anatomic and physiologic systems were more or less indifferently discussed. At the end of each chapter was a section on the effect of alcohol and tobacco on the human body, particularly on the growing child. Food was usually dismissed with a short paragraph, and such questions as fresh air, sleep, diet and personal hygiene were either not discussed at all or mentioned only casually and in most indefinite terms. Personal hygiene discussions were a series of "do-nots" rather than positive directions for right living.

Today, this is all changed. Not only school textbooks but newspapers, magazines, advertisements and the daily mail are filled with a large and varied assortment of health education material. The world was never so well informed—and misinformed—on health matters as it is today. People in all walks of life, from the highest to the lowest, are appealed to in matters relating to their personal and collective well-being.

When the modern era of health education began, there was a gradual change from the enforcement of laws and regulations applying to the control of infectious and contagious diseases, which up to that time had constituted the end and aim of health work, to an effort to improve the health of the adult group. Experience soon showed this to be a difficult task, as have been all other forms of adult education. By the time maturity is reached, habits of all kinds are quite firmly fixed, and little progress can be made in changing them. An adult may change his ways of living under the stress of an emergency, but, as soon as possible, he will revert to his former mode of life.

Next, some sporadic attempts were made to introduce health teaching into colleges and higher classes in public schools. This was usually tagged with a physical education label and, in many instances, resulted in the development of a winning athletic team, with the rank and file absorbing their health teaching from the side lines and bleachers.

It is only within the past few years that serious effort has been made to incorporate the teaching of health subjects in the common school curriculum. Today, hardly more than a beginning has been made, although sufficient evidence has been brought to light to show that even the public school pupils are not the

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†Editor, *The Nation's Health.*

ones on whom to concentrate for most effective results. In the preschool groups lies the greatest hope for proper health education. At least, the work must be begun in this group if satisfactory results are to be obtained in the school period.

In considering the preschool group, the excellent work of the parent-teacher associations in the summer "round-up" should be mentioned. The objective of this activity is to see that every child entering school for the first time will do so after having a physical examination and as far as possible having all defects corrected. In the entire country, tens of thousands of children are now entering school in the best possible physical condition, where, a few years ago, no attention was given to their health.

The health of the preschool group can be materially affected by prenatal health work. It has been said that health education, to be really effective, must begin with the grandparents. This will not be possible until our present public school group attains to that dignified state. The present generation of parents is too indifferent to health problems to offer much hope and help. They belong to the unteachable adult group referred to previously. Their children are teaching them rather than they teaching their children.

There is a tendency in some educational quarters to overemphasize the teaching of health, to set it up as a separate subject in the course of study and have it presented by a teacher specially trained in the work. This, I think, is wrong. If there is anything in the scheme of education that deserves practical every-day application, it is this subject of health. There is already too much overcrowding of the curriculum with specialized subjects that should find a place in the usual branches. Health lessons can be taught in reading, writing, arithmetic, geography, spelling, history, grammar, music, drawing; in fact, no branch of common school education but lends itself to this application.

One of the most effective ways of impressing health facts on a child's mind is to have him develop some pictorial scheme of his idea. The poster is one of the most effective means for driving home health lessons, and, in many cases, most striking health ideas have been developed. Posters have the advantage of simplicity and easily available materials for their construction. The work of C. Carroll Smith, school dentist of Peoria, Ill., in health education by means of posters is familiar to you all and is worthy of high commendation.

I am sure that you will all see ready and interesting ways in which the teaching of health can be applied both in the common school subjects and in original poster work as above suggested. The greatest drawback to the application of these principles is the lack of qualified teachers to do the work. Before it will be possible to make proper advancement in health education, it will be necessary to educate the teachers. They must be taught health before they can teach it to those under their care. And so the most pressing problem in connection with this work is to find ways and means of getting the necessary health information across to the teachers and those now in preparation for this work. The attack should be directed at the normal schools and teachers' training institutions.

The public has almost a surplus of general and popular information poured into it from every side. Even the professional health workers are years behind in putting into effect the information already available regarding personal and community health. What is needed is

not more information, but ways and means of applying what we have.

In the control of communicable diseases lies the greatest hope of health betterment among children. Smallpox, typhoid and especially diphtheria can be controlled to the point of practical extinction. In some cities, notably Auburn, N. Y., there has not been a death from diphtheria in more than three years. Other cities have records almost as good. An intensive effort is being made to rid the State of New York of diphtheria by 1930, and the state health commissioner reports most encouraging progress in this work.

Scarlet fever control is apparently just around the corner, using methods comparable to those found so valuable in diphtheria. Measles is being attacked vigorously, with hopeful progress in several laboratories.

We all know that the common contagious diseases of childhood leave prolonged if not permanent disability in their wake. Heart disease is one of the more common end results of these infections. Just how much cancer, nephritis, cerebral hemorrhage and other degenerative diseases depend on the common contagious diseases in early life we do not know. But we are aware of the fact that if the child is protected from such diseases in early life, he stands a better chance of living out his allotted span than does the child not so protected.

One of the largest problems is to obtain the fullest possible cooperation of parents in having their children protected against these diseases. Once that is accomplished, the other items on the health education list will be of comparatively easy application.

It has been said that "if we know, we are already half way toward our goal; if we know how to apply what we know, we have traveled three-fourths of the distance; but unless we are willing to work whole-heartedly we shall never reach the journey's end." In no instance does this apply more than in health education work.

A word about the vast amount of so-called "popular" health education may not be amiss. Earlier in this discussion, the use of newspapers, magazines and similar vehicles for the spread of information on health subjects was indicated. Much of this material is propaganda, often of a sinister kind. I hesitate to think of what the human race would come to were we to heed all the advice of renowned "experts," many of whom have responsible scientific and university connections, regarding food, clothing, etc., that is offered for the taking. If we drank all the liquids, from milk to carbonated beverages, if we ate all the varieties of soups, meats, fruits, vegetables, desserts and other foods, if we wore all the types of under-garments and shoes that are recommended as vitally necessary to continued existence, not only would life be one continued round of torment and discomfort, but it would certainly be necessary to take the fifty-seven varieties of laxatives and cathartics which greet you from billboard and printed page, in order to maintain a semblance of normal physiologic function. Then, after all this excellent advice had been followed for a sufficient length of time, it would be necessary to call in the family doctor to set you on your feet again. What an excellent prospect to contemplate under the guise of health education!

In this picture, we have left out the marvelous health giving properties of cosmetics and dental preparations. It is a formidable list to contemplate. In fact, it is awe inspiring to see the lengths

to which "health education" has been carried in the commercial world.

On the other hand, it goes to show that the idea of health has taken deep root in our national consciousness; which makes all the more necessary the proper training of our children in this subject.

We are living in an age of speed. Socially and scientifically, we have developed much faster and farther than we have biologically. Frederick P. Keppel, president of the Carnegie Corporation, has asked if man has not "reached the stage where he has a great deal more knowledge and power over inanimate nature, more power over his environment and understanding of his environment than he has knowledge of himself and of his relations among his own kind?" He goes on to say: "I do not think it is a fantastic thing to say that science and industry can hardly dare to go very much farther in wresting the secrets of nature before we are confident that mankind as a whole can be trusted with them."

Here, then, is a challenge to health education. If such mighty forces await domination and use, surely no race of physical or mental weaklings can hope to cope with them successfully. Man's intellect is what has set him apart from other members of the animal kingdom and made him what he is today. But if his intellectual development has enabled him to discover forces that threaten his physical well-being, it is high time that effort be concentrated on fortifying him against self-destruction. And this is what health education does when it is brought into play in its most practical sense.

The future is bright for a better race. The raw material in the shape of newborn lives is a constant supply. The satisfaction of having a part in this effort should spur on all those having a real desire to be of service to their fellow men.

THE NURSE AND TEACHER IN A PUBLIC HEALTH DENTAL PROGRAM*

By WILLIAM R. DAVIS, A.B., D.D.S.,† Lansing, Mich.

DURING the past year, as I was filling engagements in various parts of Michigan, I carried an outfit for making a careful examination, with mouth mirror and explorer, of one school room in a community. This procedure was valuable for several reasons. It provided the best kind of opportunity to show adults present just what mouth conditions exist and to teach them the facts that they need to know about mouth hygiene. It gave a good cross-section of conditions, and later examinations will show whether our program is accomplishing real results. It also provided first hand facts right in their own community to present before organizations that we were to address in that community.

We chose second grades because the first permanent molars had erupted, and

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by taking the same grade in each locality, better comparisons and statistics were afforded.

This survey, from Benton Harbor to Port Huron in the Lower Peninsula and from Marquette to Ironwood in the Upper Peninsula, revealed the following: 86 per cent of the children needed fillings or extractions or both; 56 per cent had cavities in the permanent teeth, and 55 per cent had definite mouth infection, pus and putrefactive substance running down the throat twenty-four hours of the day. In a great many cases, this was not from one abscessed tooth but from six, eight or ten. Remember these were mostly 7-year-old children. In the worst cases, the children were underweight and often pale and sickly. If these abscesses had been on arms, legs or body where Mother had to bandage them, she would have been greatly alarmed, but because they were in the mouth, mixing with the saliva and constantly running down the throat, she did not realize the condition. Chronically abscessed teeth are not often painful. They have passed that stage, but are much more harmful than before. Many children are taking their food through a sewer although the mouth, which is the gateway to the body, ought to be a clean healthy portal.

These are not idle dreams of an enthusiast but can be vouched for by teachers, nurses, school superintendents, physicians, dentists and others who were present during these examinations and had an opportunity to see for themselves. School dental examinations by health departments in Detroit and Grand Rapids this past year revealed similar conditions in vast numbers of school children. These conditions are a menace to health and may mean permanent injury. They also are a heavy drag and expense in the school program. Such children cannot do good school work. The first room in which we saw these conditions entirely remedied jumped a half grade the next year by doing the whole year's work in the first semester. There was not an absence during the whole year on account of sickness, except that of one little girl who had pneumonia. This also can be attested by principal, teacher and nurse. Many places have made such an experiment, and in every case health was improved and scholarship improved.

Another unfortunate fact, and one little understood by the laity and some dentists, is that more than half of all permanent molars come through defective and need filling almost immediately. You will notice that more than half of these children had cavities in permanent teeth, which had only been through about a year.

These are time-worn facts to most of this audience and we hesitate to repeat them, but we do need them for a background. They also need to be reiterated again and again. We fear also that even the dental profession as a whole does not even yet realize the enormity of these conditions and the part the profession must play in changing them. Repetition is fundamental in advertising and I believe is justifiable in the same way in our efforts.

This state of affairs challenges our attention, and there are just two things that we know of today that can do much toward changing it. One is diet and the other is dental care. Both of these facts must be kept constantly in mind in any dental health program. Diet is very important, but you will notice that these children cannot be helped much without, first, the extraction of abscessed teeth and roots, and the filling of those started toward de-

struction. We hope that we may some time know how to develop perfect teeth, immune to caries. Diet undoubtedly will help, but, at the present stage, preventive dentistry is also absolutely essential and, fortunately for the public, is the cheapest and most lasting dentistry.

In any educational program, the teacher and the nurse are our best allies in getting these facts home to pupils and parents. The nurses' opportunity to spread intelligent dental information and correct many erroneous ideas concerning the teeth and proper dental care is scarcely equaled by that of the dentist himself. Her contacts are so intimate and confidential that it gives her opportunity to win the utmost trust and confidence of those in her care. She is, therefore, in an exceptionally strategic position to give much needed instruction on health. This is true of the nurse in private practice; and for the school or public health nurse, this opportunity is multiplied many fold. In fact, she is expected to instruct on matters of hygiene; and mouth hygiene is just one part of general hygiene.

The prenatal nurse and the nurse in charge when the baby is born have an opportunity to give intelligent dental health instruction at a time when diet is most important in helping to form good bones and teeth. All nurses have the opportunity of explaining the supreme importance of early dental care and its real economy.

What we have said of the nurse applies in a great measure also to the teacher, with the added advantage that the teacher sees the children every day and can bring in health instruction naturally and, because she is with the children daily, can follow it up and get results. The public also feel that the teacher and nurse are not likely to be biased. They have nothing to sell.

The simple facts of dental health instruction should be in every nurses' and teachers' training course. The instruction need not be elaborate nor require great study. These facts consist of the following: the proper diet before birth and afterward; the deformities which may be caused by pacifiers or finger sucking; the evil effects of mouth infection; the importance of care of the deciduous teeth; the importance of the first permanent molar and how to tell it from a baby tooth; the fact that teeth often come through with defects which may not be seen; the supreme importance of early dental care and why it is easiest, most lasting and most economical, and proper habits of cleanliness.

This information is not technical and can be furnished in very simple form. In fact, technicalities should be avoided: they only confuse and detract from the main essentials. There has been a tendency to try to give too much in such instruction. Keep away from the "-ologies."

This information should be a regular part of fundamental health education. We know that such instruction has been wofully neglected in most nurses' and teachers' training schools; and, we might almost say, in some medical and dental schools. But even if it were neglected in the training course, any teacher or nurse can easily be provided with pamphlets which supply it. I have also many, many times given such instruction while making a careful dental examination of a school room of one of the lower grades. In fact, we believe that this is the best means of all for teaching the essential facts of mouth hygiene.

Within the last few days, we had occasion to conduct such an examination in

one of the schools used for teaching purposes by one of our normal colleges. Among others present was one of the department heads of the college, and he expressed himself very enthusiastically as to the value of such a demonstration and wished all of his prospective teachers could be reached in this way. It is worth a whole series of lectures.

We know that teachers and nurses are anxious to get this instruction and a workable plan for better mouth conditions. The first S.O.S. calls which came to the Bureau of Mouth Hygiene, when it was established, were from school nurses, saying: "Mouth conditions are terrible in our community. What can you do to help us?" They had a right to expect help, and yet they had no money to spend and our bureau had none, except for educational material and my traveling expenses. We have developed a plan which they can use with the cooperation of teachers and local dentists, and the nurses have seized it with enthusiasm. The plan is, in brief, furnishing educational material and working for 100 per cent dental rooms. We do not claim this idea as our own. In fact, we do not think any health plan should be named for an individual, institution or state, even if they developed it. The reasons are obvious. We want to work together for the best. The value of the dental honor roll was first brought home to me in 1920 when a nurse and teacher used it to obtain that first completed room mentioned above, in our first school dental work. Its value was so markedly shown that we have continued to use it, and always with good results. We wish we had space to quote from letters of nurses who have been using the plan outlined only a few months. They have been so encouraging and gratifying that we are satisfied that we should give as much time as possible to helping nurses and teachers. It does bring results. The remarks of local dentists are also illuminating in this connection and show that it is bringing results. We are happy to say that most local dentists are cooperating in a splendid way. There has been a marked increase of interest in these matters on the part of the dentists the past few years. Many local dentists have given unstintingly of their time to help promote the cause of better mouth conditions in their community, not only in word but also in deed. Some have helped the nurse and teacher to get 100 per cent rooms by doing work in worthy cases which otherwise could not have had it. We also know that dental work for children is not usually so remunerative and sometimes takes more time and patience and is done at a real sacrifice. But the nurse and teacher can put across an excellent dental educational program. It will not accomplish results in improving conditions unless most of these children get the necessary children's dentistry. We must never lose sight of this fact.

We know that there are some who say that it is too big a problem and that we cannot hope to do much with this generation, but must concentrate on the next. We grant the importance of the next, but are confident that the dental profession is not going to back down before the large problem of here and now. Progress is being made. A well balanced program will greatly improve present conditions. We have seen it tried.

We are thoroughly convinced of the importance of reaching the expectant mother, the infant and preschool child. There is no question that this must be our ultimate aim. It is more difficult because we do not find here the organ-

ization through which to work that we find in the school. But here again the nurse comes to the front, for she has most of the contacts with this group and is in a better position than any one else to reach them. She is found in most all the prenatal, infant and preschool clinics. In the Michigan Department of Health, we have a large Bureau of Child Hygiene and Public Health Nursing, especially in behalf of the expectant mother and infant. We found the bureau eager to cooperate in spreading the gospel of mouth hygiene in all its work. In fact, that certainly is part of its task. What the bureau wanted was the right kind of information on the subject.

I am glad to take this opportunity of saying that I have had the most cordial cooperation and assistance from the Bureau of Child Hygiene and Public Health Nursing and the Bureau of Education, and I am working with them as much as possible. This, of course, is as it should be. We are all striving for the same end—improved health conditions.

Leaving out of consideration entirely the question as to the desirability of a separate teacher of mouth hygiene, the fact remains that, in most of our localities, this is not possible. There is no question that the nurse should be the first employed worker, for she represents a general health program. There is no question as to her interest in mouth hygiene. Her despair is as to how to get results when she sends the children to the dentist, and he refuses them service. We want to say again, with all the emphasis possible, that no program by anybody can do much to change present conditions unless the dentists remove infection and help prevent it by early filling.

Give me a community in which nurses, teachers and local dentists are cooperating in an intelligent program in behalf of better mouth conditions, and I believe that I can show you more results than can be accomplished in any other way.

PUBLIC AND PROFESSIONAL USEFULNESS OF THE DENTAL HYGIENIST*

By ETHEL COVINGTON, Denver, Colo.

JUST as electricity requires points of contact to transmit power to its varied phases of usefulness, so the American Dental Association, in order to transmit knowledge and experience essential to dental progress, requires its points of contact, which are the various sections of this great convention.

This contact benefits the American Dental Hygienists Association by confirming our belief that the dental hygienist is of actual service in the preventive dentistry and dental health education program. It gives us unlimited courage to know that the leaders of this great dental health plan, who largely make up the personnel of this section, recognize the future possibilities of our auxiliary branch of dentistry. It supplies us with that knowledge which is the out-

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growth of your half century of combat with dental defects. It furnishes us with the highest ideals of service.

Through this contact, you dentists whose absorbing interest is "Prevention First," will be broadened when you learn how the dental hygienist is rapidly growing into the oral health and general health education program of our country.

Enough has been said in generalization regarding the usefulness of the dental hygienist, so I am going to be very definite and personal in giving illustrations of work actually being done.

The most far-reaching service of all hygienists is that of Miss Evelyn C. Schmidt, who supervises the Bureau of Dental Health Education of the American Dental Association. In addition to her program of lectures and radio talks, and the compiling of new educational material and information on the oral hygiene activities of the different states, in 1927 she assisted for six weeks in organizing the Philadelphia Mouth Hygiene Association. During the year, she addressed eight state dental association meetings, and consulted with the state health commissioners wherever feasible on the possibility of starting dental health programs under official auspices, and of having a dentist as a consultant to, or member of, the state board of health. She also planned an exhibit on dental health for the Smithsonian Institution.

At least four universities employ hygienists as directors of the dental hygienist courses of training. These are: Miss Charlotte Klatt (University of Pennsylvania), Miss Cora Ueland (University of Minnesota), Miss Margaret Bailey (Temple University, of Philadelphia) and Mrs. Frances Beardsley (Marquette University, of Milwaukee). The Territorial Normal School of Hawaii conducts a training school for hygienists with Mrs. Agnes C. Bickerton, a dental hygienist, as director of the two years' course.

Three state departments of health employ dental hygienists in an executive capacity in their dental division: Miss Dorothy Bryant (Maine), Miss Eleanor Gallinger (Massachusetts) and Miss Dorothy Miller (Connecticut).

This fall, the American Child Health Association, with Herbert C. Hoover as its president, will start an extensive health program for the entire country, which will include three dental hygienists among its workers, Misses Sadie Abrich, Margaret Maguire and Phyllis Quinby.

Perhaps less spectacular but of immeasurable value is the work of the hygienists in city and county.

Miss Helen Rosenthal, supervisor of the Dental Hygiene Division of the Department of Health, Bridgeport, Conn., with Dr. W. C. Coon, health officer, taking an entire year for the task, has completed a survey of 24,000 school children of Bridgeport, covering sixteen racial groups, which shows that race has little effect on the percentage of cavities of school children. A report of this summary appeared in the May, 1927, issue of *The Nation's Health.*

In the city of Honolulu, Miss Helen Baukin supervises the work of twenty hygienists in the public schools. These hygienists are at least high school graduates with a two-year training course in the Territorial Normal School. Included in their course are 120 hours of English composition, 108 hours of educational psychology and 300 hours dental hygiene practice. Thus, they are trained teachers as well as prophylacticians.

Miss Elma Platt of California works under county hospital supervision. She examines and lectures to the children of sixty schools, many of them rural, including schools 60 and 70 miles from her central office. The children whose parents cannot afford corrections are brought into the county clinic. During the last year, the primary departments of Sacramento County have been practically freed from dental defects.

In Colorado, the dental hygienist works most satisfactorily into the dental health education plan of the Colorado State Dental Association.

Under the organization of the University of Colorado, six health agencies cooperate in health conferences which are held in many parts of the state each year. Such an organization as this has unlimited advantage over that of the different agencies working separately.

The majority of the time the Colorado State Dental Association has participated in these conferences, its representative has been a dental hygienist. About 50 per cent of the conferences are held in rural communities where there is not a dentist. Here, the hygienist makes the examinations, explains about the cavities in both deciduous and permanent teeth and urges the parent to take the children to a dentist for correction.

In towns large enough to have four or five dentists, the dentists alternate in the examining. All explanations regarding the findings are made to the parent by the dental hygienist. This avoids embarrassment on the part of the dentist examining patients of another dentist and makes uniform all dental information which is given in the conference.

Leadville and Buena Vista are typical examples of the dental benefit these conferences are to children. Leadville is a mining town situated in the heart of our mountains at an altitude of 10,000 feet. In this town, 235 children were examined, 197 of whom showed dental defects. Seventy of these had abscesses. Of the 197, 115 received dental attention as a result of the conferences. Buena Vista is a small town in a farming district. Ninety-six children were examined, eighty-nine of whom showed dental defects, twenty-five with abscesses. The check-up here showed that forty-two of the ninety-six had received dental attention.

Statistics regarding the states, counties and cities employing hygienists are too voluminous to be included in this paper. The majority of the hygienists under such employment are in public school work.

Many dentists feel that prophylaxis in the schools should be done entirely by dentists and that oral hygiene should be taught by teachers and school nurses.

In the schools of my own city, which is typical, one hygienist averages 1,250 prophylactic treatments for children each year. These are children whose parents cannot possibly afford this service in dental offices. There are nearly 3,000 hygienists in the United States. At least 1,000 of them do school work. Therefore, 1,500,000 children receive prophylactic care each year who could not secure it any other way. In addition, many millions of school children are given toothbrush drills and lectures on the home care of the mouth by hygienists who have had special training for this work.

Using these same figures, we will make a modest comparison of the economic saving it is to have this work done by hygienists rather than dentists. At a salary of $1,800 a year, it costs the community $1,800,000 for hygienists. If

1,000 dentists were employed to do this prophylactic work, at salaries of $3,000 each, the cost would be $3,000,000.

These figures prove that the only hope of carrying out an extensive dental prevention program in the public schools is through the dental hygienist.

Teachers do not have the time or the inclination to lecture on mouth hygiene or conduct toothbrush drills, and school nurses, who have no dental training (and as you know this dental training cannot be attained in a short course) are much too busy with their general health work to take on the added responsibility of examining teeth.

We must consider the professional value to dentistry resulting from presenting of dental information through the medium of dentists and dental hygienists in schools and public health work, rather than leaving it entirely to teachers, nurses and health agencies.

A few days ago, I stepped into the office of a periodontist who employs a hygienist. This dentist is a student and a thinker, typical of hundreds of dentists in the United States. He is among those dentists who, nine years ago, helped put the hygienist law through the Colorado legislature.

I asked him what his reaction to the hygienist's work is today.

He thought a while, then answered, "I'll tell you frankly, I am disappointed. The whole idea is not working out as I had supposed it would. I believed that every busy dentist would have a hygienist to assume the simple prophylaxis demanded by the public as a preventive measure. I saw within the next eight years a sufficient number of hygienists in the schools, in industry, to clean up the teeth of this city and keep them clean. So far as I can see, it has all been a failure."

Being a hygienist with an earnest conviction that at least 95 per cent of the hygienists in the United States are performing an unparalleled service for the children of this country, I answered, "There are two possible reasons for your disappointment. The dentists have been afraid to give the hygienist a trial, or there are too many dentists in this city to need the assistance of the hygienist."

The patient in the chair, an interested physician, here took part in the discussion: he said, "If there are too many dentists in this city to need the dental hygienist, why is it that I send my patients to dentists and they return with from $20 to $150 worth of work in their mouths and their teeth have not been cleaned? If every comparatively busy dentist would do all of the work needed in the average patient's mouth, including prophylaxis, he would be swamped. He would have to have assistance, and the legitimate solution of his problem is to employ the dental hygienist."

This shows that the majority of dentists do not appreciate the possibilities of the dental hygienist in private practice.

In her capacity of cleaning teeth, giving instruction in home care of the teeth and training in the principles of correct diet, the dental hygienist may well be called the extension of the dentist's contribution to the welfare and health of his patients.

This survey of the actual work being done by the dental hygienist brings us to the conclusion that her usefulness to the dental profession and the community, in their campaign of education and prevention, whether in schools, industry, public health work or private offices, is limited only by the cooperation and vision of the dental profession.

700 Majestic Building.

SOME OF THE NEWER PHASES OF ORAL HYGIENE WORK IN LOS ANGELES COUNTY HEALTH DEPARTMENT

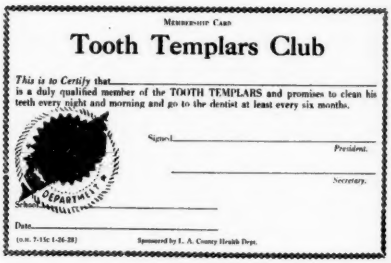
By EMMA DURBIN, Los Angeles, Calif.

AN oral hygiene club has been organized in many of the county schools. The children have named it the "Tooth Templars Club." All children of the fifth, sixth, seventh and eighth grades who bring a certificate from the dentist saying that their teeth are all cared for and who promise to brush the teeth well, night and morning, are eligible for membership. There are three grades of members: those mentioned above comprise the first class. The second class members bring certificates for themselves and one for a smaller brother or sister or other small child whose mouth hygiene they are to supervise, and the third class is composed of those who bring certificates for two or more younger children.

The club meetings are delightful and the children make every effort to keep in good standing.

In one small school visited recently, all the children from the fifth to the eighth grade had every defect corrected. The small president (aged 12 years) presided with the greatest ease and altogether according to Roberts' Rules of Orders.

After all the regular business had been finished, the president called the "sergeant-at-arms" and asked if there were any applicants for membership. The answer came, "Yes, Madam President, we have one." The president then said, "Sergeant-at-arms, you will bring the applicant forward and she will present her credentials." (A certificate from the dentist is required.) "Now, sergeant-at-arms, will you present the applicant to the first station for instruction." The applicant was then brought to the president, who gave her some


MEMBERSHIP CARD

Tooth Templars Club

This is to Certify that_____ is a duly qualified member of the TOOTH TEMPLARS and promises to clean his teeth every night and morning and go to the dentist at least every six months.

Signed_____
President.

_____
Secretary.

DEPARTMENT

Date_____

(O.H. 7-15c 1-26-28) Sponsored by L. A. County Health Dept.

Fig. 1.—Club membership card.

health instruction; next, to the second station, the secretary, and from there to the treasurer, who asked her to hold up her right hand and swear that she would brush her teeth well both night and morning and go to the dentist every six months. "There are no dues," he said, "but you will be fined five cents every time you refuse to take any part in the meetings when you are asked to do so." Then he presented her with her membership card and pinned her little policeman button on her, saying, "Frances, I hereby give you your badge of

membership. See that you do nothing to bring discredit on it."

Original Tooth Templars songs were sung and a paper on "Which Family Would You Rather Be?" was read.

The club has a "nurse," who was then called on for her report. She arose and read the names of all the children in the fourth grade whom she had examined daily for six weeks and found with clean hands, nails and teeth and whose washing of their hands before lunch she had supervised. These children are allowed to sit in the back of the room and listen in, as next year they will be "Tooth Templars."

One difficulty met last year lay in getting the local dentists interested enough to work for the children and give them certificates, so a plan was devised of making such dentists as would consent honorary members of the "Tooth Templars Club." At the conventions since then, they have been asked to sign a little book in which is written the following pledge: "I hereby promise to take care of the children who come to me for dental work to the best of my ability. I will do for them what I would wish some other dentist to do for my own children." Each name is numbered, and there is now a large group of the best dentists on our list. After they sign the book, they are given a copy of the enclosed "Symbol of Service to Childen." This has helped a great deal because the dentists are having these symbols framed to hang in their offices, and mothers, seeing them, know such dentists are interested in working for children. It also gives a list of dentists in each town in the county to whom to refer mothers.

The Symbol of Service to Children

No.

In appreciation and recognition of your active and unselfish work in behalf of healthy mouths for the children of your community, the Oral Hygiene Division of the Los Angeles County Health Department has placed your name on the Honor Roll of the "Tooth Templars Club" this ——— *day of* ——— *192*—

Los Angeles County Health Officer

Director, Oral Hygiene Division

Fig. 2.—Dentist's certificate of service.

The poster and essay contests are going along with as much or more interest than ever.

This year, the children have been asked to write on the subject: "What the County Health Department Is Doing for the Children of Los Angeles County." Hundreds of letters have been received from the schools asking for in-

formation. The enclosed digest from each division has been sent out. We believe that the results are going to be well worth while as the teachers are urging the subject in their English, hygiene, civics, art, penmanship and other classes. The poster contest is confined to oral hygiene.

These are a few of the measures employed to keep the interest of the children until they get past that difficult period during which it is so hard to enlist their interest. They will then enter high school in good condition.

A new project is being started now in the University of Southern California College of Dentistry. The county public health association is offering a medal for the best thesis on the subject, "The Relationship of Public Health and Preventive Dentistry," to be submitted by senior students. They are already working hard on the project, and those who have visited the health office to talk it over personally are amazed at the scope of the subject. They say they never thought of it in its entirety before. When these young people graduate, they will not have to be urged to take care of children's teeth, but will be eager to do so.

NEW YORK STATE RAISES QUALIFICATIONS FOR SCHOOL DENTAL HYGIENISTS.

By action of the New York State Education Department, dental hygienists engaged in public school work are now considered as dental hygiene teachers. They must be certified as such in order that local boards of education may receive the state quota toward their salaries. This provision is the same as is required for all other teachers. Qualifications for certification as a dental hygiene teacher are: (1) registration as a dental hygienist in New York State; (2) credentials showing completion of at least twelve semester hours work in approved professional courses in health education. Provision is made allowing those now employed in or entering school work in 1928 a reasonable time in which to secure the second qualification.

The summer courses at Buffalo State Teachers College have been approved by the state education department.

FREE DENTAL TREATMENT FOR CUBAN CHILDREN

Free dental treatment has recently been established by the Cuban Department of Public Health for public school pupils of Havana and nearby towns, when their parents cannot afford to pay for such service. To facilitate the service for suburban children, conveyances have been provided to take them to the dental offices.

FIELD NOTES

The Massachusetts Department of Public Health and the Massachusetts Department of Education are planning a summer course for dental hygienists to be held at Hyannis Normal School from July 2 to August 10, 1928. The required courses are: "School Dental Procedure," by Eleanor B. Gallinger, D.H., Massachusetts Department of Public Health, and "Principles of Teaching Health Subjects," by Amy E. Hale, State Normal School, Keene, N. H. "Nutrition" (half course), by Esther V. Erickson, consultant in nutrition, Massachusetts Department of Public Health, is elective. The courses are open to graduate dental hygienists who are doing dental public health work or who wish to do it. Required courses are held in the morning only, elective courses in the afternoon. Tuition is free to all who live in Massachusetts or who teach in Massachusetts. For all students attending the summer school, there will be an incidental fee of $5.00.

The following brief report was received from Miss Harriett Davis, Community Dental Hygienist in Brattleboro, Vermont: "In August, 1924, a dental health program was started in Brattleboro, Vt., with a dental hygienist in charge. The members of the school board were interviewed in order to familiarize them with the work and permission was obtained to work in the schools. School boards in nine towns extended their cooperation so that nine towns, with a total of fifty-four rooms, were worked in. Prophy-

lactic treatments to the number of 1,026 were given to children of all grades. There were twenty-eight dental clinics held, with forty-five children undergoing reparative work. The second year, eight towns, with a total of thirty-eight rooms were visited. Prophylactic treatments numbering 735 were given in the primary grades only. Dental hygiene talks were given monthly in each room except during the winter months when it was impossible to get about. Home calls were made. Talks were given to parent-teacher associations, training classes and summer camp girls. In Brattleboro, there was a preschool clinic held during 1926 and 1927. In 1926, the work was similar to that of the two previous years, with a little more emphasis on the dental educational work, and this general line of procedure is being carried out this year.

A new flyer "Baby Teeth and the Sixth Year Molars" has been received from the New York State Department of Education. It was written by Stanleigh R. Meaker, supervisor of oral hygiene, New York State Department of Education.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Vitamin A Deficiency in the Guinea-Pig: A study of the effect of feeding a diet deficient in vitamin A to a strictly herbivorous animal, the guinea-pig, is reported by S. B. Wolbach and Percy R. Howe (*Arch. Pathol.,* February, 1928). As in man and the albino rat, the specific effect of the deficiency was found in the substitution of stratified keratinizing epithelium for normal epithelium in the respiratory tract, alimentary tract, eyes, parocular glands and genito-urinary tract; suggesting that the epithelial change is the expression of a fundamental physiologic requirement amenable to study. The duration of life of the animals was from 66 to 110 days. The only external signs of vitamin A deficiency were cessation of growth and loss of weight. Localized edema and epidermal proliferation were two early changes thus far determined. Other postmortem observations were emaciation, atrophy of the salivary glands and the testes, and the effects of extensive keratinization of the epithelium in the trachea, bronchi, bladder and uterus. In contrast to findings in the rat, formation of keratinizing epithelium occurred before pronounced atrophy of the organs concerned, and there were considerable amounts of normal appearing fat distributed throughout the body. There was also an early and extraordinary degree of change in the bladder and the uterus of the guinea-pig.

What Is Health Education? This "improvement of public and personal health" is merely a statement of an age-old quest of strength and beauty which has been one of the concerns of the human race throughout the generations. Health education is simply the way in which one generation transmits to the next generation its accumulated wisdom regarding effective ways in which life may be more virile, more abundant, more satisfying. Health education, in its modern sense, then, is the new expression of a very old concern, a new responsibility which has been thrust upon the home and the schools in our generation, and which is attended by many unsolved problems and difficulties. It is distinctly a product of modern scientific advance. It represents an attempt to assort the avalanche of facts with which the scientific progress of the Nineteenth Century has deluged us, to appraise these facts for health education purposes, and then to apply them by so changing our mode of education that our children and children's children may benefit to the fullest degree. The new health education is, in effect, an educational revolution which might almost be compared to the revolution in modes of transportation and of communication. The rapid strides of progress have left in their wake many antiquated models of automobiles, of steam engines, of radios, and of cables. Is it to be wondered at that we are encumbered with prewar models of educational administration as well? To help rebuild these antiquated educational models in terms of our modern scientific knowledge concerning the nature

of children and their needs is the purpose of the Health Education Division of the American Child Health Association. The hallmarks by which the new models in education may be distinguished from the antiquated are: Education today is concerned with the child's life during the entire twenty-four hours of the day. We are wholly dissatisfied with an education which provides merely for the acquisition of knowledge done up in neat packages called "school studies" or "courses." Education, defined as an improvement in the quality of human living, must give the child the ability to carry on, with joy and effectiveness, the varied activities of daily life—of work and of play, of citizenship and of parenthood. And with this change in point of view, it has become pure common sense to consider health development as fundamental.—*Five Years of the American Child Health Association: A Bird's-Eye View.*

Convulsions During Anesthesia in Dental Cases: Two cases of convulsions during anesthesia for the extraction of deciduous teeth are reported by F. W. Clement (*Cur. Res. Anes. & Anal.,* March-April, 1928). In a child, aged 7, nitrous oxid-oxygen was given too deeply by the dentist, a practitioner of little experience, and respiration was arrested. Administration of oxygen restored respiration but the child did not become conscious, and presently went into a convulsion lasting half an hour. This was followed by quiet sleep, from which the patient awoke in a normal condition. The cause of the attack was believed to be a prolonged anoxemia. In the second case, the child, aged 4, was poorly developed, pale and nervous. During extraction of several carious teeth, convulsive movements developed, but these were corrected by administration of oxygen, which was again given at the close of the operation. Instead of recovering consciousness, the child went into convulsions, which continued under further administration of oxygen, made imperative by impending asphyxia. The lower bowel was thoroughly cleaned out and 10 grains of sodium bromid was injected, with atropin, one one-hundred-fiftieth grain, hypodermically, by the family physician. In fifteen minutes, the child began to cry, but the mentality seemed clouded, and on falling asleep, the child did not awake for nearly twenty-four hours, when it seemed to be in usual spirits. The outstanding feature of this case was the fact that, while oxygen administration was necessary to prevent cyanosis, the convulsive attack seemed to be fostered by the oxygen therapy.

Bromid Eruption on the Hard Palate: A case of bromid eruption on the hard palate, in a Russian Jewess, aged 50, is reported by F. H. Dillingham and L. K. McCafferty (*J. A. M. A.,* March 17, 1928). The eruption first appeared on the arms and legs, a few days after the patient had taken three doses of bromid in one day. A week later, the lesions on the arms and legs had become large, elevated and crusted, and when an upper plate was removed from the mouth, two grayish, granulomatous elevations, about 18 mm. in diameter, in the posterior aspect of the hard palate, slightly separated by the median line of the hard palate, were revealed. These lesions were slightly painful. Under tenth-normal saline solution, given intravenously, the patient improved rapidly. It is believed that the bromoderma on the hard palate was produced by the friction of the plate against the mucous membrane.

"Code for the Physician:" Koan Ogata, who lived 1812-1893, translated from the original Dutch and revised Hufeland's "Code for the Physician." The scroll, as reproduced, with emendations by T. Irukayama, is translated by Shiro Tashiro and Martin H. Fischer (*J. A. M. A.,* April 7, 1928), as follows: I. The physician lives not for himself but for others. This is the essence of his profession. Do not look for fame or profit. Work to save others though you lose yourself. Maintain life, restore the sick and ease the suffering of men. You have no other object. II. Face to face with a patient, remember only that he is sick, not his station or his wealth. Compare the rich man's handful of gold with the poor man's tear of gratitude. Which will you have? III. When practicing your art remember that the patient is the target, not the bow or arrow. Do not play with him. Think without prejudice; consider with narrowed eyes. IV. Besides being modern and erudite, learn how to win the confidence of your sick man through word and action. But let these be not superficial, casual or pretentious. Do not mouth deceptive and queer hypotheses. V. At night, think over the happenings of the day. Record your experiences and observations. Such benefit the patient and the world. VI. One deliberate examination and one visit are superior to many careless examinations and

many visits. But do not refuse to make frequent calls on the ground that such degrade your dignity. VII. Even when the disease is incurable, understand the sufferings of your sick man and do your duty by trying to maintain his life. It is human to surrender. Even when you cannot save him, you can comfort him. This is the human art. Try to prolong his life even though it be for but a moment. Do not tell him of the hopelessness of his state. Through your discretion in work and manner, you will not let him guess the real situation. VIII. Make the patient's illness cost him as little as possible. Of what use to save his life when you take away the means of its maintenance? IX. The physician must win the good will of the public. However skillful your science, however dignified your conduct, you cannot impart to advantage the good within you unless you hold the confidence of your people. You must understand man and the public's state of mind. You who are interested in life, who must listen to naked truth, who must hear the confession of shameful sin, need character and gentleness. Avoid gossip. Silence is better. Nor need I warn you against gambling, drunkenness, sexual excess and anxiety for fame. X. Respect and love the colleagues of your profession. But, if impossible, at least be patient. Do not discuss other physicians. To narrate their shortcomings is the shame of the wise man; to talk of their defects is the business of the small. A moment's discussion of a single error may work perpetual injury to a reputation. Consider such consequences. Every physician has his own characteristics and his own methods. Do not judge lightly. Respect the older physician and endear the younger to you. Stress their better side and refuse to comment on their treatment since you have not seen the patient. XI. A consultation should not include many—three at most. Select the right men. In conference, consider only the safety of the sick man and argue nothing else. XII. A patient may leave his physician to consult you. Do not be deceived. Hear the former physician's side. But where convinced that the treatment has been in error, it is against the code to be indifferent. Especially when critical, act, and with vigor. These twelve mandates have I written and showed to a few, but mainly did I write them for my own guidance.

Postanesthetic Anoxemias: Seventeen cases in which oxygen was administered after anesthesia to correct anoxemia with its various effects: nausea, vomiting, increased respiratory rate, periodic respiration, progressive increase in pulse rate, headache, visual disturbances, irrational states, coma and cardiac symptoms, are reported by John H. Evans (*Cur. Res. Anes. & Anal.*, March-April, 1928). Only one case resulted fatally. In one case, there was severe hemorrhage; in two cases, hyperthyroidism made the patients poor risks; in three cases, there was a postoperative pneumonia, and in three, severe bronchitis with cyanosis. The author believes that the administration of oxygen of high concentration in cases of postanesthetic anoxemia is a valuable therapeutic measure and its employment should not be neglected. He calls attention to the fact that anoxemia may be present in the anemic without cyanosis.

Ganglion Injection in Trigeminal Neuralgia: Hoppe (*Münch. med. Wchnschr.*) uses Härtel's method with 70 per cent alcohol, dose 0.5 c.c. His material comprises 125 patients, including ambulant cases. He gives in tabular form the history of fifty-one patients, in thirty-three of whom a follow-up examination was possible. He can report eighteen permanent cures of more than twelve years, two of over nine years, one of over eight years, four of over six years, two of over five years, three of over four years, one of over three years. These patients all had total anesthesia when discharged. Of the eighteen patients discharged with partial anesthesia, two have remained free from attacks for five years, three were symptom free till their death (from eight months to seven years).—Abstr. *J. A. M. A.*, March 3, 1928.

Treatment of Trigeminal Neuralgia: Furno (*Policlinico*) has treated nineteen cases of trifacial neuralgia with arsphenamine intravenously and quinine hydrochloride by mouth. In the milder cases, improvement began after the first two or three injections. So far, there has not been any failure.—Abstr. *J. A. M. A.*, Jan. 21, 1928.

Physical Therapy in General Practice: Among various conditions successfully treated by physical therapy, France L. Laffoon (*Arch. Phys. Ther. X-Ray Rad.*) reports a case of Vincent's infection in a girl, aged 15, in which the condition of the throat and gums cleared up after the first treatment. Infected

cervical glands require not more than three treatments, and in severe cases, the ultraviolet ray is used in addition. The author reports good results in a few cases of pyorrhea treated. He states that, in these cases, the applicator must be in contact with the quartz window of the burner and the gums must be dehematized from pressure of the applicator. A third or fourth degree burn must be produced to assure results and only a few teeth can be treated at one sitting, as the reaction will cause some discomfort in eating.

Postoperative Suppurative Parotitis: A series of cases of postoperative suppurative parotitis, studied with a view to determine their etiology and to disprove the theory that pressure on the jaw exerted by the anesthetist in an effort to prevent swallowing the tongue might have been the source of the condition, are presented by Charles N. Combs (*Cur. Res. Anes. & Anal.*, March-April, 1928). In the case in question, the surgeon's record stated that the anesthetist was responsible for the condition, and the author, who was acting as anesthetist, acquiesced in this finding because he was unable to controvert the statement. He quotes one article, by Deaver, as bearing out this theory: "During ether anesthesia there occurs difficulty in breathing, spasm of the muscles of the larynx, cyanosis, etc., and in endeavoring to overcome this condition the anesthetist carries the jaw forward by pressing against the angle of the jaw. Sometimes, indeed too often, this procedure is not carried out as gently as it should be, and this causes the parotitis." In the cases cited by the author, parotitis was a complication in eight abdominal cases, an incidence of one in 1,400 cases. A search of the literature revealed that practically all cases followed abdominal operation. Fisher suggests that it is of hematogenous origin. From the author's cases, it would seem that infection confined to the parotid gland has a good prognosis, but suppuration manifested as diffuse septicemia is liable to prove fatal. The author questions the theory that this condition may be due to oral infection ascending through Stenson's duct as there are no cases recorded in which it followed extraction of carious teeth, incision of buccal abscesses or removal of impacted molars or of septic tonsils.

MISCELLANY

BOOK REVIEWS

Partial Denture Construction. A Text-Book Describing the Technics of Impression Taking and the Construction of That Type of Removable Partial Dentures Which Are Supported and Retained by External Attachments. By Edward Kennedy, D.D.S., New York City, Consulting Dental Surgeon, with Special Reference to Postoperative Dental Prosthesis; Skin and Cancer Hospital, New York City. Formerly Demonstrator of Prosthetic Technics, Crown and Bridgework, Dental School of University of Pennsylvania, Philadelphia. With 401 illustrations. 470 pages. Price, $7.50. Published by Dental Items of Interest Publishing Co., Brooklyn and New York.

This book covers a field which has not till now been covered in the same comprehensive way in a book. It is to partial denture construction what similar books have been to crown and bridge work, and the subject is treated in a thorough and capable manner. The illustrations are good and the printing and paper are exceptional.

The book should be in the library of every one who attempts to do this kind of work.

A Laboratory Guide in Bacteriology, Particularly for Students in Dentistry. By J. L. T. Appleton Jr., B.S., D.D.S., Professor of Microbiology and Bacteriopathology, and C. K. Bryant, B.S., Assistant Professor of Microbiology and Bacteriopathology, Dental School, University of Pennsylvania, Philadelphia. With 38 engravings, 223 pages. Price, $2.75. Published by Lea and Febiger, Philadelphia.

This is a carefully prepared work based on fifteen years' experience in teaching dental students, and it will well repay careful study. In addition to dental diseases, it takes up such subjects as tuberculosis, the

streptococcus-pneumococcus group and the diptheria group of bacteria.

While these are not strictly dental topics, it will do little harm for the student of dentistry to be broadened out by collateral reading of this type, and the book is commended in this regard.

High Frequency in Dentistry. By Louis C. Barail, Professor of Electroroentgenology at the Ecole de Chirurgie Dentaire et de Stomatologie of Paris, Dental Surgeon to the Paris City Schools, Director of the "Revue Dentaire d' Electrologie." Preface by J. de Groes, Professor Suppliant at the Ecole Dentaire. Second edition, 47 pages, illustrated. Price, $1.00. Published by "La Verrerie Scientifique," 12 Avenue du Maine, Paris, France.

This is a small work written with apparent care, and will prove of especial value to those who are interested in electrosmosis. It deals with the treatment of the various dental diseases by the high frequency current.

Dental Infection and Systemic Disease. By Russell L. Haden, M.A., M.D., Professor of Experimental Medicine, University of Kansas School of Medicine, Kansas City, Kan. With a foreword by Dr. Edward C. Rosenow, Illustrated with 63 engravings, 165 pages. Price, $2.50. Published by Lea & Febiger, Philadelphia.

While the precise rôle played by dental infection in the causation of systemic ailments is not definitely settled, the present volume is an earnest effort to contribute to its solution. That there is a broader point of view taken in this work than has sometimes been apparent in the past is evidenced by the following statement in the preface: "Dental infection is only one of a number of important factors in the causation of systemic disease, yet it must be kept constantly in mind. Almost all of the abnormal conditions arising from infected teeth may also come from chronic foci elsewhere in the body." When the concentration on the teeth as possible factors in infection was at its height, such a statement would hardly have been admitted in a book on this subject.

It is hoped that the combined wisdom of many observant investigations will eventually settle this matter to the satisfaction of all, and the present volume is an effort in this direction.

Our Baby's First Seven Years. A Baby Record Book Including Scientific Charts Which Will Prove of Practical Service to the Mother and Growing Child. Compiled by Hermien D. Nusbaum, with the aid of Dr. and Mrs. D. A. Horner and Dr. and Mrs. J. K. Calvin, for the Mother's Aid of the Chicago Lying-In Hospital. Illustrated by Ethel Schacherer. A Gordon Volland Publication. Price, $2.50. Published by The Buzza Company-Craftacres, Chicago, Minneapolis, New York.

This is a very attractive record book which will lend interest to the rearing of a child, and it should be in every home where there are children.

There are brief introductions by Drs. Isaac Abt and Morris Fishbein, and all the various activities of childhood are listed for record. If advantage is taken of the facilities for making comprehensive records, the book will eventually prove not only of the greatest interest but also of the greatest value. We recommend the book to every family.

The Ernst Jessen Foundation

The International Dental Federation, through its Commission on Hygiene, proposes to celebrate the seventieth birthday of Professor Jessen by raising a fund to be known as the Ernst Jessen Foundation, the interest on which shall be offered to municipalities or other bodies who have done the most effective work in school dental care, and, in furtherance of this idea, the secretary of the Commission, Dr. J. S. Bruske, has made the following appeal:

Letter From Dr. Bruske

Amsterdam, March 2, 1928.

Dr. W. H. G. Logan,
Chicago, Ill.

Dear Dr. Logan:

On January 19 last, I wrote you relative to the seventieth birthday of Prof. Jessen and the homage to be extended to him on that date. I am aware that a deplorable fact kept you from answering my appeal, but the time between now and May 10 is so short that I fear it might become quite impossible to obtain a convenient amount from the U. S. A. if no immediate action is taken. I carried on a correspondence with Professor Jessen regarding publication of the appeal which so far bore a confidential character. However, in my mind, it is much preferable to have the matter published in our professional press. Professor Jessen agreed. In consequence thereof, I have drawn up a new draft for an appeal, copy of which I enclose.

From the third paragraph, you will notice that a new sentence has been attached to the effect that alternatively the total of contributions may be applied toward a Professor Jessen Foundation, the annual interest of which is to be offered to such municipality or any other body in authority as will achieve the most effective results in the domain of school dental care. Professor Jessen fully agrees with this idea, as far as he is familiar with our steps. Professor Jessen also agrees with the publication of the appeal in our professional press.

In the enclosed draft, you will see that I have attached a list of names under it. Those were the colleagues who immediately expressed their willingness to join.

As already stated, I have addressed the same appeal to all countries affiliated with the F. D. I., and we have so arranged it that in every country a treasurer has been appointed. Needless to state, we leave it to you to appoint such an officer for the U. S. A.

In case contributions in the U. S. A. might be received late, owing to the fact that the length of time between receipt of this letter and May 10 is fairly short, I would suggest that, in this case, the treasurer be instructed by you to cable the proceedings to our H. C. treasurer, Dr. B. H. de Beer, 126, de Lairessestraat, Amsterdam, or, still better, cable the figure of the total amount anyhow.

Thank you very much for your letter of February 28 in which you accept the invitation of the H. C. to collaborate, and for the appreciation you express in their work.

Very sincerely yours,

Enclosure J. S. Bruske.

Re Homage to Prof. Dr. Ernst Jessen.

Dear Colleagues:

On May 10, 1928, the very meritorious chairman of the Hygiene Commission of the Federation Dentaire Internationale, Prof. Dr. Ernst Jessen, hopes to celebrate his seventieth birthday.

The undersigned, recognizing the great merits of this pioneer in the domain of mouth hygiene, especially in connection with his life's work, the furthering of dental care at school, which he started practically in 1888 in Strassburg, and the results of which have been spread in all civilized countries, and appreciating his exemplary leadership during over eighteen years since 1909 in his capacity as chairman of the H. C., now intend to offer Professor Jessen a lasting proof of their homage.

In fact, it is Professor Jessen's heart's desire to have a permanent fund at his disposal, enabling either the foundation of a standard dental school clinic or a Jessen Foundation, out of the annual interest of which a prize will be offered to such municipality or body in authority as may have achieved the best results in the domain of mouth hygiene.

The amount required for the accomplishment of Professor Jessen's ideal can be obtained only by the collaboration of all colleagues and dental organizations that are willing to contribute in an international way so as to give proof of their sympathy toward Professor Jessen and his work.

In consequence thereof, the undersigned solicit the collaboration of all dental organizations affiliated to the F. D. I., and of as many colleagues as possible, realizing that a great homage of the sort would not only be well deserved, but that the foundation of such an institution would represent an example of such a character as should be of great interest to buccal hygiene.

So we kindly ask you to send promptly to the undersigned designated as treasurer:

1. The amount you are willing to contribute.

2. Your signature or card, it being intended to have the names of all donors brought together in an address to be handed to Professor Jessen when transferring the funds to him.

Confraternally yours,

For the Exec. Council, F. D. I.
F. Aguilar, Madrid
Geo. Villain, Paris
A. L. J. C. Van Hasselt, The Hague
Ch. F. L. Nord, The Hague

For the H.C.-F.D.I. Members of the Board:
H. J. Burkhart, Rochester
J. S. Bruske, Amsterdam
H. B. de Beer, Amsterdam
H. G. Pitsch, Amsterdam
J. Visser, Amsterdam
Joh. Brun, Oslo
F. Watry, Antwerp
F. Ferrand, Paris

For the Members of the H. C.-F. D I.:
K. Schaeffer-Stuckert, Frankfort
K. Cohn, Berlin
A. E. Rowlett, Leicester
E. Haderup, Copenhagen

R. Jaccard, Geneva
U. S. A. Treasurer:
Harvey J. Burkhart,
Box 35, East Ave. P. O.,
Rochester, N. Y.

Dr. Logan's Letter

April 5, 1928.

Dr. J. S. Bruske,
121 Stadhouderskade,
Amsterdam, Holland.
My dear Doctor Bruske:

Your communication with reference to the homage to be extended to Dr. Jessen on his seventieth birthday has been turned over to Dr. C. N. Johnson, editor of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, with the request that he act as chairman for the group in the United States, and I have designated Dr. Harvey J. Burkhart as treasurer for this country.

I have suggested to the chairman, Dr. C. N. Johnson, that the personnel of his committee in the United States be as follows:

L. Pierce Anthony, Philadelphia.
Henry W. Gillett, New York.
Percy R. Howe, Boston.
William H. G. Logan, Chicago.
Rea Proctor McGee, Los Angeles.
R. Ottolengui, New York City.
William D. Tracy, New York City.
Charles R. Turner, Philadelphia.
Alfred Walker, New York City.
Herbert L. Wheeler, New York City.
Roscoe H. Volland, Iowa City, Iowa.

Your suggestion that you be cabled by May 1 the amount of the contribution of the United States is, of course, beyond accomplishment for the reason that more time will be required to secure the approval of our colleagues in the United States for their names to be signed to the appeal as it goes forth in our dental journals. Therefore, the earliest publication of the appeal in our dental journals will not occur before June or July. For that reason, we have changed "the request for money to be secured before May 1" to read "to send promptly to the undersigned designated as treasurer."

Yours very sincerely,
W. H. G. LOGAN.

THE GORGAS MEMORIAL INSTITUTE

That the United States government is to accord recognition to the Gorgas Memorial in its research work is indicated by the friendly vote in Congress on the bill to appropriate $50,000 annually to a Gorgas laboratory in Panama. It is expected that South American countries will contribute to this fund, making an expenditure of nearly $100,000 a year for this memorial activity.

The Memorial is operated on funds from medical, dental and lay sources. Several dental societies have made appropriations for this object. The Metropolitan Life Insurance Company is giving $30,000 for its educational work, on the basis of particular emphasis for the periodic health examination.

The present officers of the Gorgas Memorial include Franklin Martin, president-elect of the American College of Surgeons as president, with W. H. G. Logan, former president of the American Dental Association, secretary. Calvin Coolidge is honorary president.

The dental phase of organization activity is now being stressed by the call for dental health articles for release in the big daily newspaper syndicate of the Memorial, which reaches every state in the Union. Another feature of the educational publicity lies in the plan under way whereby speakers are sent out from national headquarters to various clubs and groups, emphasizing medical and dental policies, and urging the yearly health examination by the family doctor and the twice-a-year visit to the dentist for a "keep well" program.

The rapid growth of the Gorgas Memorial, its recognition by national authority and the aid granted it by large private interests, together with added medical and dental support assured, is one of the interesting health achievements of the last few years.

DONALD MACKAY GALLIE, D.D.S., *Chairman*,
Gorgas Memorial Committee,
American Dental Association

CORRESPONDENCE

To the Editor:

I had the pleasure of attending in 1926 the Seventh International Dental Congress at Philadelphia, and much appreciated the kindness, consideration, and good fellowship which I experienced there from my American colleagues and from those of other countries assembled. The paper by Dr. S. M. Khambatta on "The Present Status of Dentistry in India" came, therefore, as a jarring note and its publication in your journal, I feel, calls for a little criticism. Had Dr. Khambatta confined himself to a general statement

about government indifference to dental matters, which all countries experience more or less, one could let the matter pass, but unfortunately, by repetition, he makes his paper, like so many of his countrymen, a general attack on the British Government in India. It may not be generally known in India, but total prohibition of unqualified practice was not obtained in Great Britain itself until 1921 and that only after many years of organization by the dental profession itself. Dr. Khambatta complains that there is not a governmental dental school. Does he not know that in Great Britain practically all the dental schools have been founded and endowed by the public spirit of wealthy private citizens and that the fees paid for training at such schools would be much greater were it not so? This also applies to many British medical schools and universities at which Indians who come to Great Britain are educated.

My own dental clinic has been established and is maintained by a large industrial corporation privately, and is typical of many others in this country.

I write this letter not to stir up political controversy, but to direct attention to a point of view which I think so many Indians miss, and which is that they expect too much of any government and rely too much on the government instead of on themselves.

What is apparently lacking is public spirit amongst Indians themselves, particularly the wealthy ones. If Indians can establish industries, especially in Bombay, surely they are capable of finding the money for dental purposes, and I sincerely hope that Dr. Khambatta's public appeal will not remain unheard by his fellow countrymen, who have the means to help.

Furthermore, far from blaming the 150 years of British government in India for the conditions, the marvel would rather be that with such a heterogeneous mixture of religions, races and languages, the British government has done so much to improve sanitation, irrigation and medicine. This has been done in spite of Indian opposition and not with their help.

I trust that much of the energy and money now spent in political propaganda against the Indian government may be diverted to education and enlightenment of the people of India in dental and health matters.

As a looker-on I feel that this viewpoint of self-help has been missed by our Indian colleagues.

Yours faithfully,

WILLIAM HOLDEN SHIPWAY, L.D.S., R.C.S.,
Bristol, England.

NEWS

Dr. Howe Honored: At the recent meeting of the Connecticut State Dental Association, the Newell Sill Jenkins medal was awarded to Percy R. Howe, Boston, Mass., President-elect of the American Dental Association. This medal is awarded each year to some one who has made a notable contribution to dentistry or some other science or to humanity in some other manner.

Connecticut State Meeting: The Connecticut State Dental Association held its sixty-fourth annual meeting in New Haven, April 11-13, with a registration of 750. Ten essays and forty clinics made up the program.

Preliminary Program for A. D. A. Annual Session: The Preliminary Program of the Seventieth Annual Session of the American Dental Association, to be held in Minneapolis, Minn., August 20-24, is practically completed. (The complete program will be published in the July issue of THE JOURNAL.) Essayists are listed to the number of 105, discussers, 82, and clinicians, more than 400. Exhibitors numbering 128 to date have secured space, 195 of the 201 spaces available having been spoken for.

Chicago Dental Society Elects Officers: At the recent annual election of the Chicago Dental Society, the following were chosen to serve as officers for the ensuing year: president, Louis E. Jelinek; vice president, Herman L. Frankel; secretary, Hugo G. Fisher; treasurer, I. B. Clendenen; librarian, Ashley M. Hewett.

Dr. Wyckhoff Obtains Fellowship: Barkley S. Wyckhoff, of East St. Louis, Ill., has been granted a two-year fellowship in dental surgery at the Mayo Hospital in Rochester, Minn.

Montana Society Elects Officers: At the recent session of the Montana State Dental Association, the following officers were chosen for the coming year: president, T. P. Regan, Helena; vice president and president-elect, C. L. Smith, Missoula; secretary-treasurer, J. E. Buehler, Great Falls (re-elected). The next annual convention will be held in Butte, March 28-30.

Dr. Gordon Appointed for Laboratory Research: Samuel M. Gordon, B.S., M.S., Ph.D., has been appointed as research worker in dental materia medica for the American Dental Association in the laboratory of the American Medical Assocation. Dr. Gordon comes from the biologic laboratories of the University of Wisconsin. He received training also in Tufts College, the State University of Iowa, Harvard and the Institut Agronimique, Paris, specializing in organic and physiologic chemistry. One year was spent in teaching general chemistry and quantitative analysis to premedical and pharmacy students at the University of Iowa, during which time he also had charge of the laboratory work in organic chemistry. Dr. Gordon has also had work as a research analytical chemist in the industrial field.

Heart Disease and Life Insurance: The Metropolitan Life Insurance Company paid fourteen million dollars in 1927 for death claims due to heart disease. This disease is the cause of the largest disbursement by this company, the next being because of deaths due to violence, with tuberculosis third and cancer fourth. This means, probably, that deaths due to cancer are not in so large a proportion among persons in the insurabale age.—*New England J. Med.*

Deaths of Physicians: Statistics regarding the deaths of physicians in the United States in 1927, as reported in *The Journal of the American Medical Association,* show that the average age at the time of death was 62 years. Deaths of 2,790 physicians were reported. One hundred forty died from accidents, sixty-six from motor accidents, an increase of 83 per cent over the preceding year. Suicides increased from thirty-seven to forty-nine. The most common cause of death was heart disease, the following occurring in order of frequency: cerebral hemorrhage, pneumonia, cancer, nephritis, accidents, arteriosclerosis, tuberculosis, embolism and diabetes.

Responsibility of Husband for Dental Care for Wife: The Supreme Court of Michigan recently ruled that it is not sufficient for a husband to supply his wife with barely enough money to furnish the necessities of life, but her state of health is to be taken into consideration, and provision made by him for any needed medical or dental care.

American Public Health Association to Meet in Chicago: The fifty-seventh annual meeting of the American Public Health Association will be held in Chicago, Ill., October 15-19, with headquarters at the Hotel Stevens. The American Child Health Association and the American Social Hygiene Association will meet with this organization. Louis E. Schmidt, M.D., is chairman of the local committee and Arthur E. Gorman is secretary. Sessions are being arranged for health officers, child hygienists, public health nurses, laboratory technicians, vital statisticians, health education directors, food and drug experts, industrial hygienists and public health engineers.

Dr. Kelsey Honored: At the closing session of the Southern Society of Orthodontists, in Baltimore, April 27, a banquet was tendered Harry E. Kelsey, the retiring president, by the Baltimore City Dental Society, as a tribute to his many scientific contributions to dentistry. B. Lucien Brun acted as toastmaster and the following responded to toasts: Frederick B. Noyes, Chicago; Oren A. Oliver, Nashville; John V. Mershon, Philadelphia; Clinton C. Howard, Atlanta, and George E. Hardy, Baltimore. Dr. Kelsey was presented with a wrist watch by Walter E. Green, president of the Baltimore City Dental Society, on behalf of the society. Many congratulatory messages were received from members of the profession throughout the United States and Europe.

DEATHS

Anderson, J. E., Paton, Iowa; Des Moines College of Dental Surgery, 1901; died of pneumonia, March 28; aged 53. Dr. Anderson was a veteran of the Spanish-American War.

Braham, Hugh P., Youngstown, Ohio; Pennsylvania College of Dental Surgery, 1896; died suddenly, April 12.

Butler, W. O., Kelfield, Canada; Pennsylvania College of Dental Surgery, 1876; died April 9; aged 78. Dr. Butler was formerly a resident of La Harpe, Ill.

Crane, Frank M., East Orange, N. J.; died April 11, aged 56, from accidental asphyxiation from carbon monoxide gas.

Eddy, Charles M., Butte, Mont.; Vanderbilt University School of Dentistry, 1895; died suddenly, April 4; aged 60.

Gould, Horace P., Brooklyn, N. Y.; New York College of Dentistry, 1895; died, April 4. Dr. Gould was for thirty years an active

member of the New York State Dental Society and served as its president for the years 1919-1921.

Howard, Gordon C., Waynesburg, Pa.; died, March 22; aged 74.

Kells, C. Edmund, New Orleans, La.; New York College of Dentistry, 1878; died, May 7; aged 71. Dr. Kells was an inventor and the author of many contributions to dental literature. He invented the first dental electric engine driven by street current; introduced the use of compressed air into the dental office; took the first dental roentgenograms and gave the first dental roentgen-ray clinic. He also originated the use of the diagnostic wire in root canal work. It was Dr. Kells' devotion to research in the use of the roentgen ray in dentistry which culminated in his death. A short time ago he had undergone the forty-ninth operation necessitated by roentgen-ray burns sustained in his early research experiences in this field.

Knapp, C. W., Gibson City, Ill.; Northwestern University Dental School, 1896; died, April 3; aged 60.

Louderback, Andrew V., Chicago, Ill.; Northwestern University Dental School, 1905; died, May 3; aged 60.

Van Horne, Herman E., Glen Ridge, N. J.; died, April 7; aged 78. Dr. Van Horne retired from practice in New York eight years ago because of ill health.

ANNOUNCEMENTS

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, August 20-24, 1928, Minneapolis, Minn.

Alumni Association, College of Physicians & Surgeons of San Francisco, June 22-23, 1928, San Francisco, Calif.

American Academy of Periodontology, August 16-18, 1928, Minneapolis, Minn.

American Dental Assistants Association, August 21-23, 1928, Minneapolis, Minn.

American Dental Hygienists Association, August 20-23, 1928, Minneapolis, Minn.

American Dental Society of Europe, July 30-August 1, 1928, Brussels, Belgium.

American Society of Oral Surgeons and Exodontists, August 17-18, 1928, Minneapolis, Minn.

Federation of American Women Dentists, August 20, 1928, Minneapolis, Minn.

National Association of Dental Examiners, August 18, 1928, Minneapolis, Minn.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

June (1928)

Georgia, at Atlanta (13-15).
Idaho, at Boise (11-13).
New Hampshire, at North Conway (13-15).
Southern California, at Long Beach (7-9).
Texas, at El Paso (5-7).
Washington, at Tacoma (25-27).

July (1928)

Wyoming, at Casper (9-10).

December (1928)

Ohio, at Toledo (4-6).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 25, 1928. Secretary, E. W. Patton, 725 First National Bank Building, Birmingham, Alabama.

Arkansas, at Little Rock, June 18-23, 1928. Secretary, C. L. Hunt, 402 First National Bank Building, Ft. Smith, Arkansas.

Connecticut, at Hartford, June 28-30, 1928. Recorder, Arthur B. Holmes, 80 Central Avenue, Waterbury, Connecticut.

Delaware, at Wilmington, June 20-21, 1928. Secretary, W. S. P. Combs, Middleton, Delaware.

District of Columbia, at Washington, June 12-16, 1928. Secretary, C. Willard Camalier, 406 Medical Science Bldg., Washington, D. C.

Florida, at Jacksonville, June 21-23, 1928. Secretary, R. P. Taylor, Jacksonville, Fla.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Illinois, at Chicago, June 12-16, 1928. Superintendent of Registration, V. C. Michels.

Indiana, at Indianapolis, June 18, 1928. Secretary, J. M. Hale, Mt. Vernon, Indiana.

Kentucky, at Louisville, June 8-12, 1928. Secretary, Robert L. Sprau, 968 Baxter Avenue, Louisville, Kentucky.

Massachusetts, at Boston, June 12-15, 1928. Secretary, W. Henry Grant, Room 146, State House, Boston, Mass.

Maine, at Augusta, June 25-27, 1928. Secretary, G. W. MacKay Millinocket, Maine.

Michigan, at Ann Arbor, June 11-16, 1928. Secretary, J. W. Lyons, 617-621 Dwight Building, Jackson, Michigan.

Minnesota, June 11-16, 1928. Secretary, F. E. Cobb, 601 Donaldson Building, Minneapolis, Minnesota.

Mississippi, at Jackson, June 19-21, 1928. Secretary, T. Ford Leggett, Tate Bldg., Laurel, Miss.

Montana, at Helena, July 9-13, 1928. Secretary, T. P. Regan, Helena, Mont.

New Jersey, at Trenton, June 25-30, 1928. Secretary, John C. Forsyth, 148 W. State Street, Trenton, New Jersey.

North Carolina, at Raleigh, June 11, 1928. Secretary, H. L. Keith, 409 Murchison Building, Wilmington, North Carolina.

North Dakota, at Fargo, July 10-13, 1928. Secretary, Gilbert Moskau, Grand Forks, N. D.

Ohio, at Columbus, June 25-30, 1928. Secretary, Ray R. Smith, 327 E. State St., Columbus, Ohio.

Oklahoma, at Oklahoma City, June 25-28, 1928. Secretary-Treasurer, Charles A. Hess, Idabell, Oklahoma.

Pennsylvania, at Philadelphia and Pittsburgh, June 20-23, 1928. Alexander H. Reynolds, 4630 Chester Avenue, Philadelphia, Pennsylvania.

Rhode Island, at Providence, June 26-28, 1928. Secretary, Albert L. Midgley, 1108 Union Trust Building, Providence, Rhode Island.

South Dakota, at Sioux Falls, June 25, 1928. Secretary, G. G. Kimball, Mitchell, South Dakota.

Tennessee, at Memphis, June 18, 1928. Secretary-Treasurer, F. W. Meacham, Chattanooga, Tennessee.

Texas, at Houston, June 18-21, 1928. Secretary, Maxwell C. Murphy, Temple, Texas.

Vermont, at Montpelier, June 25-27, 1928. Secretary, David Manson, Burlington, Vt.

Virginia, at Richmond, June 19, 1928. Secretary, John M. Hughes, 715 Medical Arts Building, Richmond, Virginia.

Wyoming, at Cheyenne, June 26-28, 1928. R. S. Moody, Cody, Wyoming.

MONTANA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Montana State Board of Dental Examiners will be held July 9-13, at Helena. For further information, address

T. P. REGAN, *Secretary,*
Helena

BOARD OF DENTAL EXAMINERS OF THE DISTRICT OF COLUMBIA

The next examination by the Board of Dental Examiners of the District of Columbia for dentists and dental hygienists will be held June 12-16, at Georgetown University Dental School, 920 H Street, N. W. For information, address

C. WILLARD CAMALIER, *Sec'y-Treas.,*
406 Medical Science Bldg.,
Washington

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

The North Dakota State Board of Dental Examiners will hold the next meeting at the Gardner Hotel, Fargo, July 10-13. Application for examination must be in the hands of the secretary by July 1.

GILBERT MOSKAU, *Secretary*
Grand Forks
C. F. SWEET, *President*
Minot

AMERICAN DENTAL SOCIETY OF EUROPE
(A Correction)

The forty-seventh annual meeting of the American Dental Society of Europe will be held July 30-August 1, at the Residential Palace, 155 Rue de la Loi, Brussels, Belgium, and not, as previously stated, at the Palace Hotel.

J. A. HOLDEN, *Secretary,*
40 Park Lane,
London, W. 1

TEXAS STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Texas State Board of Dental Examiners will be held at Houston, June 18-21.

MAXWELL C. MURPHY, *Sec'y-Treas.*
Temple

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The Mississippi State Board of Dental Examiners will meet at the capital, Jackson, June 19-21, at 9 a. m., for the purpose of examining applicants for license to practice dentistry in Mississippi. An examination for dental hygienists will also be given. Applications should be in the hands of the secretary at least five days prior to the date of the examination. For applications and clinical requirements, address

T. FORD LEGGETT, *Sec'y-Treas.*,
Tate Bldg., Laurel

FIRST DISTRICT DENTAL SOCIETY OF THE STATE OF NEW YORK

The First District Dental Society of the State of New York will hold its fourth annual December meeting for Better Dentistry at the Hotel Pennsylvania, New York City, Dec. 3-6, 1928. The committee is preparing a program which will be both interesting and of high scientific value. Essays and clinics will be held and progressive teaching clinics along various lines will be an important feature. The topic discussions will again occupy an important place in the program. A manufacturers' exhibit will be held in the hotel simultaneously with this meeting.

JOHN T. HANKS, *Chairman*,
17 Park Ave.,
New York City

PROGRAM OF SEVENTIETH ANNUAL SESSION, AMERICAN DENTAL ASSOCIATION

The preliminary program of the Seventieth Annual Session of the American Dental Association, to be held in Minneapolis, Minn., August 20-24, will be published in the special or Annual Session number of THE JOURNAL, the July issue. An events program will be published as a bulletin from the A. D. A. office about July 5. This will contain information regarding all social affairs in connection with the session, sports events, meetings of affiliated or specialized groups and presession news in general.

AMERICAN HOME ECONOMICS ASSOCIATION

The twenty-first annual meeting of the American Home Economics Association will be held in Des Moines, Iowa, June 25-29, with Hotel Fort Des Moines as headquarters.

ALICE L. EDWARDS, *Exec. Secy.*
617 Mills Bldg.
Washington, D. C.

CANADIAN AND ONTARIO DENTAL ASSOCIATIONS

The Canadian and Ontario Dental Associations will meet in joint session at the King Edward Hotel, Toronto, June 4-7. An attractive program has been prepared and the dentists from the United States will be welcomed as guests.

FRED J. CONBOY, *Sec'y-Treas.*
East Block, Parliament Buildings,
Toronto

FLORIDA STATE BOARD OF DENTAL EXAMINERS

The Florida State Board of Dental Examiners will hold its annual meeting June 21-23, at Jacksonville, for the purpose of examining all qualified applicants for license to practice dentistry and oral hygiene in the State of Florida. For information and application blanks, write to

R. P. TAYLOR, *Sec'y-Treas.*,
Jacksonville

FEDERATION OF AMERICAN WOMEN DENTISTS

The annual meeting of the Federation of American Women Dentists will be held in Minneapolis, Minn., Monday, August 20, at 2 p. m. General headquarters will be at Hotel Plaza.

HAIDEE WEEKS, *Chairman*,
Publicity Committee,
1207 Maison Blanche,
New Orleans, La.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The Massachusetts Board of Dental Examiners will hold an examination for registration for both dentists and oral hygienists in the City of Boston, June 12-15. Full information, application blanks, etc., may be secured at the office of the secretary, Room 146, State House, Boston. All applications must be filed at the office of the secretary at least ten days before the date set for the examination.

W. HENRY GRANT, *Secretary.*

SUSQUEHANNA DENTAL ASSOCIATION OF PENNSYLVANIA

The annual meeting of the Susquehanna Dental Association will be held June 11-12, at Sky Top Lodges, Inc., "In the Poconos."

F. L. DAVENPORT, *Chairman,*
Executive Committee,
Miners Bank Bldg., Wilkes-Barre

VERMONT BOARD OF DENTAL EXAMINERS

The Vermont State Board of Dental Examiners will meet June 25-27, at the State House, Montpelier, to examine applicants for a license to practice dentistry and dental hygiene. All applications, accompanied by examination fee, must be in the hands of the secretary at least ten days before the date of the meeting. For applications and other information, address.

DAVID MANSON, *Secretary,*
Burlington

TRANSPORTATION TO THE ANNUAL SESSION OF THE A. D. A., MINNEAPOLIS

An Identification Certificate will be sent to each member of the American Dental Association, approximately one month in advance of the meeting. When properly filled out and presented to the local railway agent, it will authorize him to sell a round trip ticket to the member for himself and dependent members of his family, at one and one-half fares. Selling dates for these tickets will be August 15-16-17-18-20 and 21, with return limit, August 30.

JOHN R. BARTIZAL, *Acting Chairman,*
Transportation Committee.

OHIO STATE DENTAL BOARD

The Ohio State Dental Board will hold its annual examination the week of June 25, at the Dental College of Ohio State University, Columbus. The hygienists will be examined on Tuesday, June 26. All applications must be in the hands of the secretary at least ten days prior to the week of the examinations. For application blanks and further information, address,

RAY R. SMITH, *Secretary,*
327 E. State St.,
Columbus

UNIVERSITY OF PENNSYLVANIA, CLASS OF 1923

The fifth anniversary of the dental class of 1923, University of Pennsylvania, will be celebrated by a reunion to be held at Philadelphia, June 14-16. Headquarters will be at the Benjamin Franklin Hotel. For details, address,

SANFORD D. LAWYER,
Greene and Chelten, Avenues,
Philadelphia

LOUISIANA STATE DENTAL SOCIETY RESOLUTION ON CHILDREN'S DENTISTRY

WHEREAS, up to the present, the attention of dentistry has been centered mainly on the work of restoring lost dental tissue, and

WHEREAS, the only hope of real progress lies in the prevention and early control of dental diseases, and

WHEREAS, prevention, to be effective, must be applied early in the life of the individual, and early in the life of the tooth; be it

Resolved, that dental service must begin early, and be systematic and periodic in order to obtain the maximum of prevention with the minimum of operative work, and to properly educate the child in habits of oral hygiene; and be it

Resolved, that in the aim to attain prevention of systematic and dental disease:

(a) No defect is too slight to receive definite attention.

(b) The temporary teeth should receive as much care as the permanent ones in order to

promote the proper development of the jaws and head, and to maintain function.

(c) Particular care and attention should be given to developmental pits and fissures, whether occurring in temporary or permanent teeth, or whether decay is or is not present; and be it

Resolved, that the Louisiana State Dental Society declares for the principles and practice of children's dentistry, and maintains that the most effective dentistry that can be done for any individual is the service rendered between the second and fourteenth years of age; and be it

Resolved, that this society calls on all dentists to uphold these fundamental principles, and to do everything possible to promote the practice of children's dentistry by professional and public education, and in public and private practice.

B. J. LACOUR, *Secretary*,
Welsh, La.

CORRECTION

Through an error at the source of our information, the death of Robert Bell, Spokane, Wash., was reported in THE JOURNAL. Dr. Bell is in good health. His brother, Alexander J. Bell, Spokane (Northwestern University Dental School, 1898), died December 22.

SOME RECENT BOOKS

Available for Circulation from the

LIBRARY BUREAU*
AMERICAN DENTAL ASSOCIATION†

Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1925.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928.
Barail, L. C.	High-frequency in dentistry. Paris, France, La Verrerie Scientifique, 1927. (Pamphlet.)
Berger, Adolph	Principles and technic of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926.
Broomell, I. N., & Fischelis, Philipp	Anatomy and histology of the mouth and teeth. Philadelphia, Blakiston, 1925.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927.
Cahn, L. R.	Modern practice of tooth extraction. New York, Macmillan, 1924.

*Formerly The Department of Literary Research.

†Books may be borrowed for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume asked for should accompany all requests for books. This will be refunded on return of books.

Clapp, G. W.	Life and work of James Leon Williams. New York, Dental Digest, 1925.
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926.
Colyer, Stanley	Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926.
Dental Board of the United Kingdom	Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926.
Dental Board of the United Kingdom	Three lectures on "dental alloys." Delivered under the auspices of the Dental Board of the United Kingdom. London, Dental Board of the United Kingdom, 1927.
Endleman, Julio	Special dental pathology: a treatise for students and practitioners. St. Louis, Mosby, 1927.
Federspiel, M. N.	Harelip and cleft palate. St. Louis, Mosby, 1927.
Feldman, M. H.	Manual of exodontia. Philadelphia, Lea & Febiger, 1926.
	First International Orthodontic Congress: held at New York City, August 16-20, 1926. St. Louis, Mosby, 1927.
Fones, A. C.	Mouth hygiene; a textbook for dental hygienists. Philadelphia, Lea & Febiger, 1927.
Fones, A. C.	Preventive dentistry. Philadelphia, Lea & Febiger, 1925.
Gies, W. J.	Dental education in the United States and Canada. New York, Carnegie Foundation, 1926.
Goslee, H. J.	Principles and practice of crown and bridgework. Brooklyn, Dental Items of Interest Pub. Co., 1926.
Greenfield, A. L.	Interpretation of dental radiograms. Rochester, N. Y., Ritter Dental Mfg. Co., 1926.
Guerini, Vincenzo	Life and works of Guiseppangelo Fonzi. Philadelphia, Lea & Febiger, 1925.
Gwinn, C. D.	Textbook of exodontia. Philadelphia, Lea & Febiger, 1927.
Haden, R. L.	Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1928.
Hanau, R. L.	Dental engineering. Buffalo, N. Y., Author, 1926.
Hanau, R. L.	Hanau intraoral method vs. Gysi extraoral method. Buffalo, N. Y., Author, 1927.
Hartman, L. L.	Teeth and the mouth. New York, Appleton, 1927.
Head, Joseph	Everyday mouth hygiene. Philadelphia, Saunders, 1925.
Hertzler, E.	Technic of local anesthesia. St. Louis, Mosby, 1925.
Hess, Walter, & Zurcher, Ernst	Anatomy of the root-canals of the teeth. New York, Wood, 1925.
Hodgen, J. D.	Practical dental metallurgy. St. Louis, Mosby, 1924.
Hogeboom, F. E.	Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis, Mosby, 1927.
Hovestad, J. F.	Practical dental porcelains. St. Louis, Mosby, 1924.
Jamieson, J. D. H.	Operative dentistry. Outlines of dental science. Vol. 9. New York, Wood, 1927.
Jordon, M. Evangeline	Operative dentistry for children. Brooklyn, Dental Items of Interest Pub. Co., 1927.
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AMERICAN DENTAL ASSOCIATION

Minneapolis, Minnesota. August 20 to 24, 1928.

HOTEL RESERVATION

The Housing Committee for the American Dental Association meeting in Minneapolis has compiled a roster of hotels approved by the Minneapolis Civic and Commerce Association and the Hotel Association.

Please be accurate in filling out the reservation form below and send it to the hotel of your first choice. You will be advised by the hotel of the receipt and listing of your reservation.

In the event that the reservation of your first choice cannot be made, the hotel manager will forward this blank to the Chairman of the Halls and Hotels Committee. He will place your reservation under either your second or third choice; or, if these are not available, in as favorable a hotel as possible. You will be advised of the name and location of the hotel in which the reservation is made and the hour at which the reservation begins. Rooms not occupied at the designated hour of the reservation may be reassigned by the hotel.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations that you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel releasing it, in order that your room may be made available for other members.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, MINNEAPOLIS, MINN., AUG. 20 TO 24, 1928

.....Hotel.

Minneapolis, Minn.

Dear Sir: Please make reservations noted below:

.....rooms with bath for.....persons. Rate: $.....to $.....per day per room

.....rooms without bath for.....persons. Rate: $.....to $.....per day per room

Date of arrival.....Hour.....

Date of leaving.....

Please note the following second and third choice of hotels:

Second choice.....

Third choice.....

Room or rooms will be occupied by

NAME	ADDRESS IN FULL
.....	.....
.....	.....

Name of applicant.....

Street and number.....City and State.....

Please confirm this reservation to applicant. I further agree to notify the hotel immediately in event I am unable to use this reservation.

Important to hotel manager:—In event that you cannot accept this reservation, please forward this application at once to Dr. W. C. Naegeli, Chairman Halls and Hotels Committee, American Dental Association, 301 Donaldson Bldg., Minneapolis, Minn., who will attend to the assignment of this reservation.

HOTELS and ADDRESS	Rooms	WITH BATH		WITHOUT BATH	
		One Person	Two Persons	One Person	Two Persons
RADISSON 7th St. between Hennepin & Nicollet	500	$3.00-6.50	$5.00-30.00	$2.00-2.75	$4.00
NICOLLET Washington at Nicollet	600	2.50-6.00	4.00-8.00	2.00	3.50
CURTIS 10th St. & 4th Ave. S.	825	2.00-3.00	3.00-6.00		
LEAMINGTON 3rd Ave. S. at 10th St.	500	2.50-4.50	3.50-6.00		
SHERIDAN 1112 Marquette	450	2.50 up	3.50 up	1.50 up	2.50 up
ANDREWS Hennepin & 8th St.	328	2.50-6.00	4.00-7.00	2.00-2.50	3.00-3.50
BUCKINGHAM LaSalle & 15th St.	138	2.50-3.50	4.00-6.00		
CAMFIELD Marquette & 8th St.	100	1.50-1.75	2.50	1.25	2.00
DYCKMAN 6th St. between Hennepin & Nicollet	300	2.00-5.00	4.00-7.00		
FRANCIS DRAKE 10th St. & 5th Ave. S.	160	2.50-5.00	3.50-6.00		
ELGIN Hennepin & 8th St.	125	1.50	3.00 up	1.00	2.00 up
HASTINGS 12th St. & Hawthorne	150	1.75-4.00	2.50-5.00		
MARYLAND LaSalle & Grant	172	2.00-2.50	3.00-3.50		
PLAZA Kenwood Parkway & Hennepin	160	2.50-6.00	3.50-6.00		
PAULY Nicollet & High	48			1.00-1.50	1.50-2.00
ROGERS Nicollet & 4th St.	200	2.00-2.50	3.50-5.00	1.25-1.50	2.50
RUSSELL 16 S. 4th St.	125	1.50-2.50	2.50-4.00	1.25-1.50	2.00-3.00
SENATOR 314 S. 8th St.	80	2.00 up	3.00 up		
ST. REGIS Marquette & 9th St.	58	1.50-3.00	2.50-4.00		
VENDOME 4th St. between Hennepin & Nicollet	250	1.75	3.00-3.50	1.25-1.50	2.00-2.50
WEST Hennepin & 5th St.	362	2.00-4.00	3.00-5.00	1.50-2.00	2.50-3.00